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August 6, 1925

Engineering News-Record

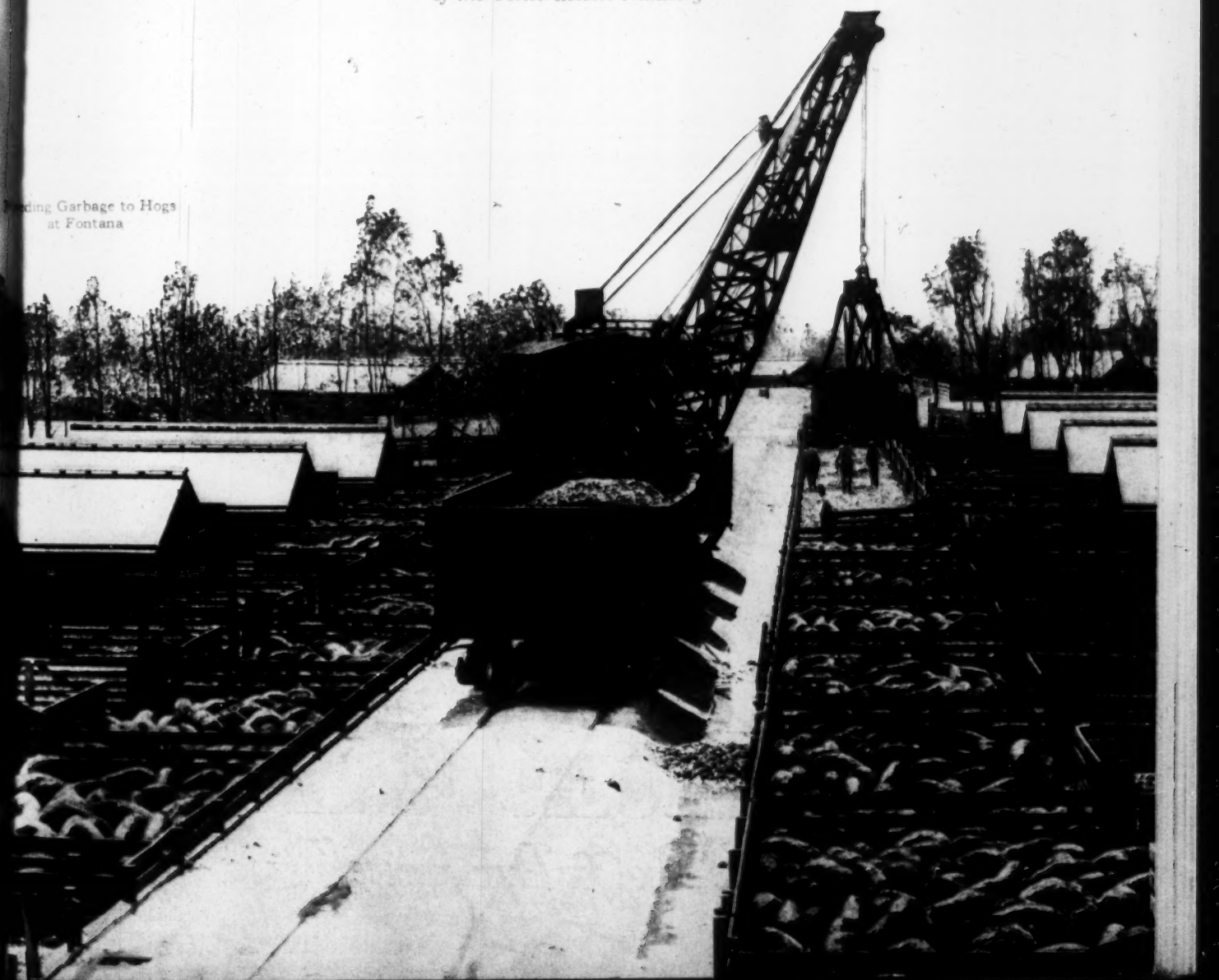
A Garage Built with Warped Floor Areas Connecting the Ramps

50 Miles of the Boston Post Road Widened and Straightened

Pitt Bowl — A Stadium of Steel and Reinforced Concrete

Los Angeles Garbage Feeds 40,000 Hogs

Engineering News-Record Statistics of the Construction Industry



ding Garbage to Hogs at Fontana

World Theatre, Omaha, Nebraska. Roofed for permanence with Federal flat slabs. C. Howard Crane, Architect.

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FRANK C. WIGHT
Editor

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A Smoother Curve

ONE of the outstanding phenomena of industry is the summer slump. Notwithstanding the fact that production must always be for some future consumption and that consumption, while seasonal for the individual article sometimes, is continuous for industry as a whole, the summer months all show low indices of business. One of the hoped-for results of a scientific study of the so-called business cycle is the smoothing out of the curve of general business indices, not only so far as the different years are concerned, but also for the year itself. It is too soon in the study of the business cycle to say that the growing promotion of scientific study of business conditions to replace belief in fatalistic intervention has begun to show results, but it is a fact that this year the curve appears to be smoother and the summer slump less evident than at any time since the war boom years. In the field of construction those who read the *Engineering News-Record* statistics have already noted the steady increase in construction activity and the stability of the price market. But reports from other industrial fields are equally satisfactory. With the exception of the coal field, now in one of its regular spasms, and of some of the textiles, evidently not yet adjusted as to wage scales, the producing agencies of this country are going into the autumn on an even keel, with steadiness of prices and wages acting as a promise of a general stability that is more satisfactory than a too steep rise in activity. Construction, being one of the base industries of all industry, should profit in the coming months by this stability.

Turnover

ONE of the details of highway management in which Europeans differ from Americans is keeping a good executive as long as they can. In an interesting booklet called "Highways of Norway," which has recently come to the editor, a particularly interesting part is the record of the three succeeding directors of public roads which Norway has had since 1874. Only three changes in chief highway executives in fifty years! In the United States eight of the forty-eight states have the same chief highway engineering executive that they had five years ago. Death has taken one or two; the others have gone for many reasons but most of them because of a turn of the political wheel.

Bringing on the Revolution

TWO years ago the people of the United States spent upwards of a half-million dollars to finance the so-called Federal Coal Commission in an investigation of the unrest in the coal industry. That commission made a report, after reading which this journal was prompted to say that "there is no simple solution of the problem of producing coal at fair prices, for fair wages and at a fair profit" and to conclude that after all its effort, the commission had really contributed very little to that solution. The present deadlock in the anthracite coal negotiations confirms that view. So far as can be seen the situation as to a prospective anthracite strike, with its attendant disturbances, is exactly the same as it would have been had not the commission reported. Whether a more emphatic report, one that really recommended some kind of decisive legislative action, would have been more effective, it is impossible to say. But it is obvious that the coal operators and the coal miners, now jockeying for advantage at Atlantic City, are facing a final crisis in the conduct of their industry. The people will not be satisfied merely to await a settlement that will inevitably be reflected in raised cost of coal. Whether we like it or not government intervention must follow too many repetitions of the usual course of these coal squabbles, a course which starts out with an employer-employee deadlock and ends with twenty to fifty cents added to the cost of coal. The United States is still a long way behind Great Britain in its progress toward socialization of industry but it will take only one or two more coal crises to bring our government to the same attitude that prevails in England, where the government has had to step in with a subsidy to keep coal moving. In most of our industries both capital and labor have learned that the dangers of nationalization can best be avoided by a proper reasonableness as to the rights of the other side and of the public. The coal industry has not yet learned that lesson.

Still Talking About Them

IN THE news pages this week is an item taken from *Engineering News* of 1875, in which the Board of Public Works of Chicago is quoted as saying that it recommends the general use of water meters whenever the financial condition will allow of their purchase. That was 50 years ago. Last week the city aldermen, despite the urgings of the present Department of Public Works and the mayor and the engineers, to say nothing of the warning of the federal government itself, postponed action on the water meter ordinance until October, because its enactment might interfere with the wasteful methods of many water users on whom they depend for re-election. Apparently, everything around Chicago has changed in 50 years except the need for water meters and the tactics of the politicians.

Broad Highways

ROAD pavements are widening out with astonishing rapidity. Seldom now do highway officials consider any hard surface less than 18 ft. wide and 20 ft. pavements are being built extensively. One state, as was noted here a few weeks ago, is paving its roads on hills to a width of 30 ft. Trunk roads for four lines of traffic are freely talked of—indeed are being built in several places, generally in short lengths into large cities. The widening of the Boston Post-Road, as described in this

issue, to carry four lines of vehicles, is a banner undertaking in this reach toward the super-highway. Here is in every respect a remarkable road structure—50 miles of reinforced-concrete pavement slab 9 in. thick and 36 ft. wide in an 80-ft. right-of-way. Ten years ago the possibility would have been derided. Five years ago the probability would barely have been conceded. The road is now being built and its future duplication is being thought of. In round figures its cost will be $100,000 a mile. Again, here is a measure of present-day highway thinking in terms of traffic and of cost. These new standards have to be impressed on a public which is accustomed to measuring performance by the mileage of road constructed.

Plains River Hazards

IT IS the pleasure of eastern engineers and contractors sometimes to become derisive of the plains rivers which flow east from the foothills of the Rocky Mountains. Indeed the Arkansas, the Platte and even the Missouri in their seasons of quiet, with their channels spotted with mud flats and gravel bars, are unimpressive compared with the Hudson, the Delaware and the Potomac. But they have other aspects. The appellation "mighty" is not merely characteristic western brag. Whenever the easterner undertakes construction in or across these plains streams he becomes respectful. He promptly removes "mighty" from its quotation marks and gives it high place as a truly descriptive adjective. An illustration to the point is the construction, described last week, of a conduit crossing the Grand River in Oklahoma. The Grand is a stream with all the deviltries of the plains river except, at this particular point at least, it does not have a shifting mud bottom. Its habits as described in the article are therefore worth being marked by any who are venturing for the first time to match their construction wits against the streams which come down from the mountains to the Mississippi. Not one of them large or small is not a hazard to any construction which attempts to cross its current. Any contractor who overlooks this fact will repent his carelessness.

Efficiency in Feeding Garbage to Hogs

GARBAGE can be disposed of with sanitary and economic efficiency by feeding it to hogs. All over the country, many use that method of disposal, although not always with high efficiency. Most of the cities are relatively small, except where in some of the larger cities table waste from restaurants and hotels is bought by hog raisers. True, there are obstacles that must be overcome to make this system of disposal a success, but so there are with other methods. Some of the difficulties of garbage disposal by hog feeding are the cost of separating garbage suitable for hog food from other waste that the householder insists on putting into garbage cans, the absence of suitable locations for large hog farms near large cities and the lack of experienced men to operate such farms in a sanitary and profitable manner. In view of these facts the article on the Fontana hog farm elsewhere in this issue should be particularly valuable as a record of progress in this direction.

The fact that the Fontana venture has weathered nearly four years of experience, including the trials of the hoof-and-mouth epidemic that visited California last year, proves that under some conditions, at least, the table waste of an entire large city can be successfully fed to hogs. At this farm 40,000 hogs are fed on concrete floors with garbage exclusively, there is an effective plan for the disposal of the large volume of residue that is one of the great problems at such disposal plants, and operation is conducted on a sanitary basis. Of course this does not prove that the same system and methods would succeed elsewhere. In fact there are two very important factors in favor of operations at this California farm which put operations there in a special class, namely, (1) the fact that Los Angeles householders have been trained to the strict necessity of putting only food waste in the garbage can and (2) the ownership by the hog ranch operators of large orchards nearby where there is profitable use for the refuse as fertilizer. With these two advantages there have still been many obstacles to overcome and problems to work out before the farm could be put on a satisfactory operating basis.

A prerequisite to the success of a garbage farm, the Fontana Company points out, is a long-time contract. Since the initial investment in concrete floors, fences, shelters, roads, equipment, etc., amounts to about $10 to $12 per hog, a reasonable return on the outlay cannot be expected if these costs have to be written off in less than ten years. Another very important matter is the problem of how to effectively handle and dispose of refuse and manure in any such quantities as 100 tons a day. Even yet the Fontana farm is not operating under wholly satisfactory conditions on this score but the plans now under way for dryers and grinders promise to bring to final form a scheme that has been very well begun in the use of the large compost pit where drainage and some degree of digestion are effected. Altogether the conditions found at the Fontana farm reflect most creditably on its operators and it is to be hoped that this record of their success may be a stimulant toward higher standards in garbage hog farms elsewhere.

The immediately foregoing words apply to existing garbage-hog farms. The Los Angeles experience also deserves consideration whenever and wherever the problem of garbage disposal is unsettled. Local conditions may count out hog feeding but its advantages should be weighed. Those who urge that however practicable garbage disposal by hog feeding may be for small cities it is out of the question for large ones should weigh this evidence to the contrary afforded by Los Angeles. That city had a population of 577,000 in 1920 and has been growing so rapidly since then that the Census Bureau now makes no attempt at estimates. Against what is being successfully done with the garbage of Los Angeles consideration should be given to abandonment of hog feeding at Baltimore after a few months' trial and at Buffalo after the method had been in use several years. There is reason to believe that the method did not have a fair trial at either city—at Baltimore because of physical conditions that might have been overcome had not those interested in resuming disposal by reduction been successful, and at Buffalo because for years the city authorities have been squabbling over garbage disposal, with no end of the squabble in sight, instead of treating it solely as an engineering problem, as has been done there with water filtration. In contrast with Buffalo and Baltimore, Newark has been getting rid of much if not all of its garbage by

feeding to hogs since about the time that the other two cities let contracts to the same end. It should be noted that about the time Baltimore turned back to garbage reduction after a short trial of hog feeding, Los Angeles shifted from reduction to hog feeding, the latter method also having been used before the contract was let for disposal by reduction. Before either of these methods were employed Los Angeles built, operated and abandoned two incinerators—perhaps in part because they were outgrown.

The hog should be given a fair chance. Reduction, incineration, "sanitary fills" or plain earth burial should each be given full consideration until all but one have been ruled out by careful study, made by a competent engineer—preferably one who is not taking up the subject for the first time.

Obstacles to garbage disposal by hog feeding must be overcome before the method can be a success, but that is true of other methods. Reduction as well as hog feeding demands exclusion of foreign material from garbage, as also though in less degree a site at a remote location. Lack of experienced operators close at hand may have to be faced with a new garbage disposal plant of any system, but the real difficulty, regardless of the kind of plant to be operated, is willingness to try to get and keep such men. Any well-governed city can find men capable of operating a garbage disposal plant of any system that it may own or if disposal is by contract can compel the contractor to find such a man or turn the plant over to the city. In other words, success or failure of garbage disposal is far more a matter of general municipal efficiency than of the particular method of garbage disposal employed, provided the method has been chosen to suit local conditions, which is again a matter of municipal efficiency.

Over the City Line

THE extension of city services over the line into adjacent territory gives rise to many problems. Some of these become contentious as the years roll on. Often, as just now at Seattle, Wash., they enter into campaigns for annexation to the city. Like many other campaigns these are not always notable for deepness of thought and soundness of argument, as is illustrated by a pro-annexation editorial in the Seattle *Times* of July 19, which is of more than local interest because it and the succeeding discussion raises questions that arise every day in and just outside of growing cities and suburbs.

Taken at its face value as an assertion of facts, the *Times* editorial, entitled "Seattle Can't Carry Non-Paying Suburbs," conveys the idea that Seattle has a weak city government and an easy-going body of taxpayers. Thus one paragraph of the editorial reads:

"It is well known that the primary reason for settling just beyond the city boundaries is to escape the higher tax rate within the city. If urban conveniences could be obtained without stint, there would be a general exodus from the city. Unfortunately somebody must pay for electric light systems, water supply, schools, garbage collection and police and fire protection. No way has been devised to get these conveniences and necessities without paying for them. If they can be enjoyed without sharing in the burden of developing the services and financing them, the users cannot evade the charge that they are imposing on a neighbor's generosity."

From this and other parts of the editorial one would infer that the services mentioned are supplied without charge to people over the line. Not only is that absurd on its face, but a later issue of the *Times* carries an "open letter" in which it is asserted that the people over the northern line pay from 2 to 4 times city rates for water, 25 to 50 per cent in excess for light and shift as best they can for the removal of refuse. But, assuming for the moment that the charges for utility service over the city line are too low, who but the city authorities of Seattle are to blame? Moreover, is the city under any compulsion to supply water and light beyond its boundaries? A proper system of financing these utilities, both within and outside the city, would remove them from the annexation controversy. It would also leave no question in law or equity as to whether the city would be justified in discriminating between water consumers in the suburbs and in the city in times of water shortage, unless that were made a contract provision.

There is reason to question the assertion of the *Times* "that the primary reason for settling just beyond the city boundaries is to escape the higher tax rate within the city"; at least without the qualification that those who cross the city line know that they must sacrifice city benefits—either go without some services covered in the city tax rate or else provide these at their own expense. Certainly many people go over city lines for the sake of other things than lower taxes, such as more open country.

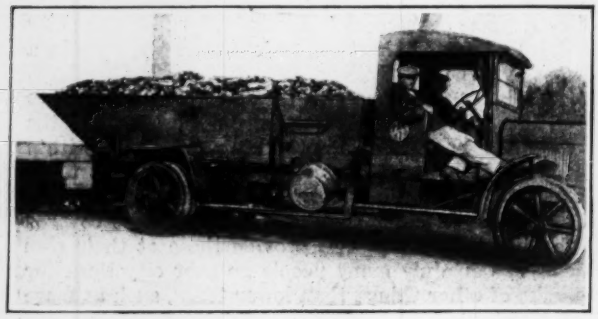
Undoubtedly there are difficulties to meet when a city extends its services over the line, for special factors enter into the fixing of proper charges in such cases. Oftentimes this is not recognized and squarely met. Perhaps this is the trouble at Seattle. Apparently there is another trouble. Whether from unexpectedly rapid growth or neglect, we cannot say, but apparently the water and electric light services of Seattle are now overtaxed. Annexation would not increase these facilities. Rather the demands for water and light would be increased. Whatever the outcome of the annexation campaign at Seattle, it certainly should lead residents on both sides of the city boundary to examine the contractual relations between city and suburbs with a view of seeing that justice is done to those within and over the city line. To a large degree the interests are mutual and demand like obligations.

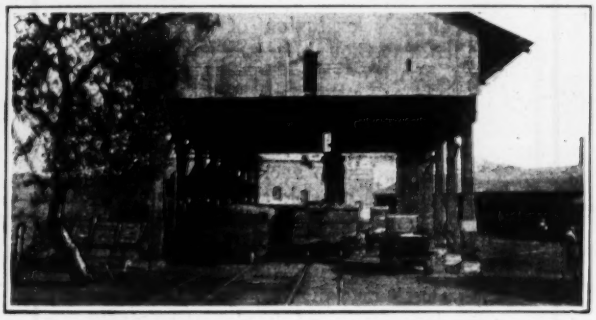
Seattle and all other cities should realize that there are many and deep reasons why a considerable percentage of their populations or what might be such settle in outlying territory rather than within the city. A better understanding of these reasons would be advantageous to all concerned. The cities might then do much to lessen settlement outside, at least while much of their area is still open country. The cities, by banding together, could obtain legislation which would promote street layouts and the provision of utility services over the city line in harmony with those within the city. This and much else could be done without sacrificing local self-government outside the larger municipal unit until these communities saw it to their advantage to be absorbed into the city—which is quite different from being clubbed in by threats of discontinuance of what are or should be contractual services entered into on mutually advantageous terms.

Los Angeles Garbage Feeds 40,000 Hogs on Fontana Farm

Grab Buckets Unload Onto Concrete Feeding Floors with Fresnos for Cleanup—Rejected Garbage and Other Refuse Goes Through 75 x 500-Ft. Concrete-Lined Pit

FOR almost four years all the garbage of Los Angeles has been shipped in gondola cars by rail 50 miles to the hog ranch of the Fontana Farms Co. where 40,000 hogs are now fed on garbage exclusively. Many improvements in methods and equipment have been made since this operation started and further development is still under way. The plant was laid out, however, with high sanitary standards and it has been found possible to operate on the extensive scale here described without causing any nuisance or offense. The investment in the hog farm totals about $1,250,000, which is divided into three parts, namely: Hogs, $600,000; plant and equipment, $400,000; estimated value of the 600 acres of land used, $250,000.





LEFT—GARBAGE TANK ON TRUCK, COVERS REMOVED; RIGHT—DUMPING GARBAGE AT LOADING PLANT

The metal tanks are lifted bodily off the truck chassis by an overhead crane and dumped into gondola cars. In the view at the loading plant, note the tank tilted up over car on track and trucks at right waiting in line. Each truck is rated as 1, 2, or 3 in quality, due to length of gathering period, and the three classes are kept separate.

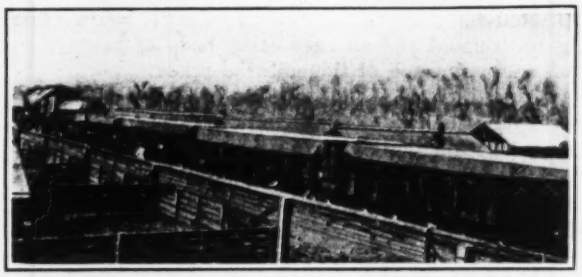
Los Angeles has been successful in rigidly enforcing an ordinance that requires householders to segregate garbage and rubbish and hence the problem of separation does not confront the operators of this hog farm. The city does the collecting with its own forces; no other agency is allowed to transport garbage through the city's streets and hence the table waste from all hotels and restaurants is included in the garbage sold to the Fontana Farms Co. f.o.b. gondola cars at the city's loading plant for 60c. per ton.

City scavengers make collections throughout the downtown hotel and restaurant districts nightly. The garbage from these routes is not only rich in quality but, coming to the cars fresh as it does, has exceptional food value and is therefore rated as number one. Garbage from residential districts, where collections are made as far apart as three days, is rated as number two, and that gathered from outlying districts where collections are made only weekly is rated as number three garbage. As each gondola car is filled at the city's loading station it is marked 1, 2 or 3 to correspond with the graduation noted above and on arrival at the farm is handled accordingly. En route these gondolas are covered with canvas which is roped down in place. These covers are cleaned with live steam after each trip and are returned to the loading plant by motor trucks.

The main farm unit at Fontana contains 240 acres and ordinarily about 26,000 hogs are kept there. Hogs are also kept at two other points where brooder camps are maintained, totaling about 15,000 animals, these being transferred to the main unit after being weaned. The main unit, in addition to its brooder section, has feeding and fattening sections and provides for the hogs in all stages of development.

The general plan of operation is to keep hogs of the same age and size together all through their development, thus securing the greatest possible equality in feeding. In general the policy is to feed only as much garbage as the animals will clean up. If fed more than this they are likely to become surfeited and go "off feed." This rate of feeding is exceeded, of course, in the case of the fattening pens and is much less in the pens where the sows are kept prior to farrowing. Any excess in the latter pens has been found conducive to fever in the mothers which affects their milk flow as well as causing small litters.

All feeding is done on concrete floors and all railroad tracks from which garbage is fed are paved with concrete and flanked with wide concrete gutters to facilitate drainage and cleaning out. In the farrowing and the fattening units the pens are paved in their entirety. In other sections where considerable "pasture" areas are included for the exercise of rapidly growing animals, only a comparatively small concrete feeding floor is used, surrounded by a curbing, the remainder of the pen being unpaved. This policy of feeding only on concrete floors throughout the entire

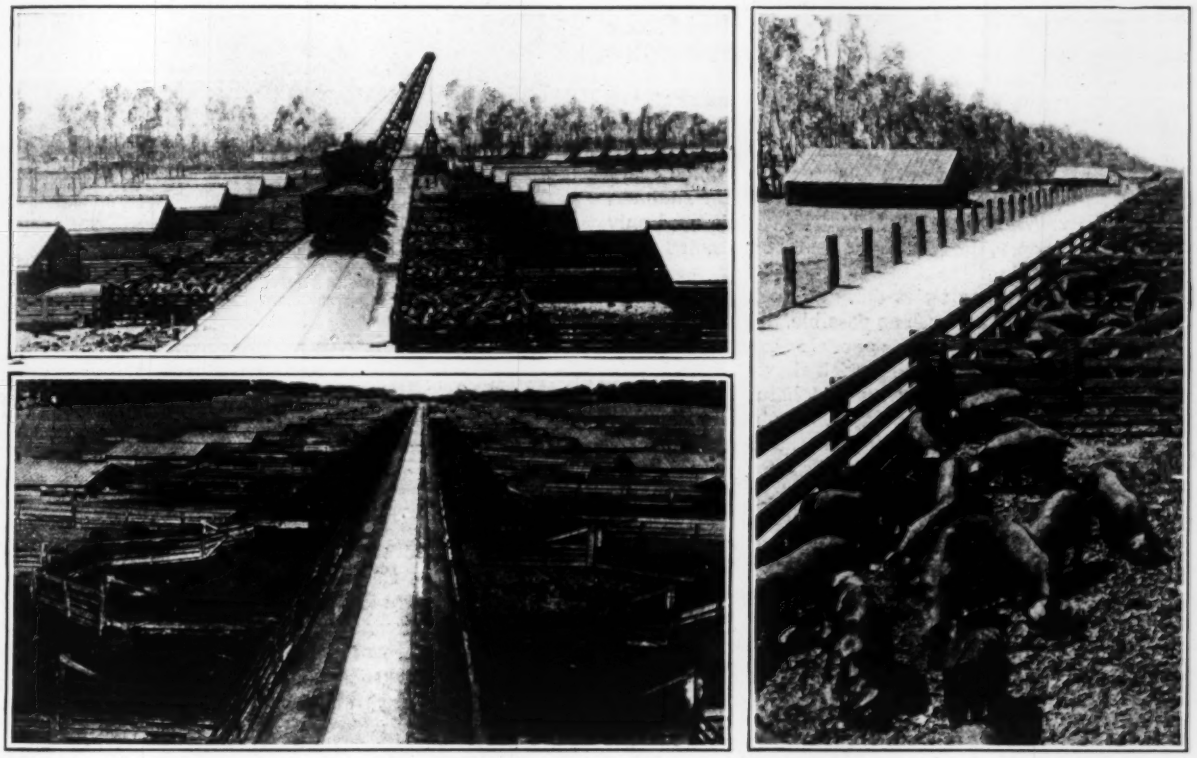


TRAINLOAD OF GARBAGE ARRIVING AT FARM

Cars are covered with tarpaulin for the 50-mile rail trip. Moving cars around the farm is done by locomotive crane.

life of the animal makes it possible to prevent the scattering of garbage that would be likely to sour and decay, makes for a very sanitary condition and does away with lodgment for rats.

The question of what type of paving to use has been given careful attention. The problem is not one of wear but rather of raveling or disintegration, presumably due to acid action. Concrete floors, 6 in. thick including a 1½-in. surface coating of rich mix, have lasted in some cases only 2½ years. A 3-in. base with 1-in. finish was found to be unsatisfactory. The 6-in. paving is now used as a standard and the surface is



FEEDING FLOORS, SHOWING UNLOADING WITH CRANE, A GENERAL SECTION AND A CLOSE VIEW

Shelters and feeding floors are concrete paved as are all railroad tracks along the feeding floors, but the remainder of the pens, the "pasture," is not concreted. Note that shelters are partitioned by fence line, each shelter serving two pens. In the section at the right, the feeding is done from wagons with aprons projecting over the fence.

given three applications of Lapidolith, a surface filler intended to give a smooth surface of maximum hardness. Experiments with asphalt paving were wholly unsatisfactory, a 6-in. paving on feeding floors having deteriorated at the rate of about ⅛ in. per day, this amount being the average depth that would soften enough to be scraped off by the fresno daily.

At the main farm unit there are about 300 farrowing pens each 7x27 ft. in plan, including a 7x8-ft. shelter in which a bedding of shavings is provided. The entire area occupied by farrowing pens is concrete paved with drainage to a common gutter passing along the row of pens. The fencing consists of wood panels 32 in. high and of a length suited to the size of the enclosure. These panels are easily lifted for the daily cleanout or for transferring the sows and their litters. The cleanout consists of scraping all food refuse and manure into gutters whence it is shoveled into wagons.

After each litter of pigs is transferred, the entire farrowing pen and particularly the shelter is disinfected and a fresh supply of shavings is put in. These shavings are used in preference to straw since they serve the purpose fully as well and cost only abont one-fifth as much. A small blackboard nailed to each shelter provides a space for the date of farrow and the number of pigs in each litter.

The weaning pens are 48x200 ft. in plan. Eight sows and their litters are assigned to each pen, the transfer from the farrowing pens being made when the young pigs are about 4 weeks old. These weaning pens have 10x32-ft. concrete feeding floors with 4-in. curbs around the edges and the remainder of the pens are unpaved "pasture." Within a period of 12 weeks, which is the average length of time the pigs are kept in these pens, they are castrated, vaccinated and weaned. Tests are now being made on the substitution of individual weaning pens, 7x32 ft. in size, where the litters can be kept separate up to weaning time.

Vaccination for hog cholera is made by the simultaneous method when the pigs are from six to eight weeks old. Those showing no temperature by this method or temperatures of over 105 deg. are given serum alone and three weeks later, serum and virus.

From weaning pens the young pigs go in groups of about 75 to pens 32x160 ft. in size, each containing a 9x32-ft. feeding floor. The shelter houses in these pens are built on the dividing line between adjoining pens so that a 20x24-ft. structure with a central partition extends into two pens, thus providing a 10x24-ft. shelter in each pen.

In the stage of development where they weigh from 75 to 125 lb., the pigs are kept in considerably larger

pens, where there is ample "pasture" room. About 110 animals are assigned to each of these pens and are fed on 9x48-ft. concrete feed floors. The shelters here are 12x32 ft. in each pen, built on the dividing line as before, and paved with concrete.

The fattening pens receive especial care as the place where the finishing or fattening takes place. These pens are built, so far as the layout of the farm permits, in continuous parallel rows along both sides of a railroad spur. Shelters, pens, feeding floors and the adjoining railroad tracks have a continuous concrete paving which is laid so as to drain readily to gutters at convenient locations, usually just outside the fences. Each fattening pen is 32x60 ft. in plan and contains a concrete-lined basin 4x14 ft. in plan and 12 in. deep that is used as a wallow.

To insure the comfort of animals in pens that are paved entirely with concrete (that is, those that have no "pasture"), peat several inches deep is put on the concrete after each cleanout. Cleanouts are made every 15 days in winter and about every month in summer, the period varying with rainfall. The peat is used only in the pens proper, the feeding floors being scraped clean after each feeding.

All feeding is done twice daily so as to get garbage onto feeding floors as fresh as possible. Feeding is done by unloading direct from gondola cars with grab buckets and also by unloading with shovels from horse-drawn wagons, the former method being used in the feeding and fattening pens and the latter in all other pens. In all pens served by crane and grab bucket (the feeding and fattening units) the feeding floors are separate enclosures, usually 12 ft. wide, extending the full width of the pen along the railroad spur, and the hogs are admitted to these enclosures only at feeding time. In all other lots and pastures the feeding floors are not fenced off and the animals have access to them at all times.

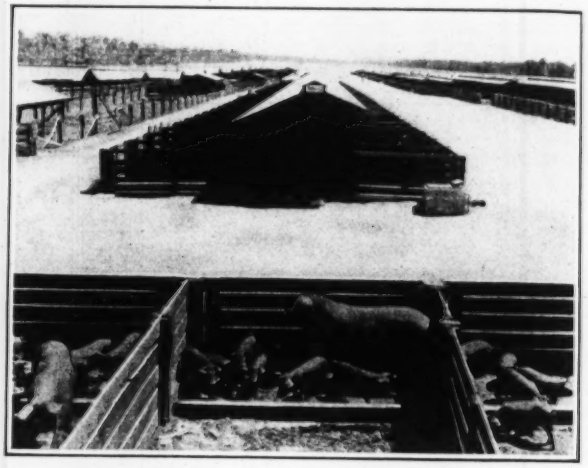
Hogs come into the fattening division when they weigh about 125 lb. They enter the pens at the upper end of the row and are daily looked over while in the feeding sections with a view to moving those that have gained most rapidly into the adjoining pen. Thus the average weight of animals in each successive pen increases from the minimum at the upper end to about 210 lb. at the lower end. Animals that are to be shipped to market are taken from the lower end of the fattening pen row.

Only No. 1 garbage is fed in the fattening pens. This is unloaded by a locomotive crane operating a grab bucket and pushing ahead of it a gondola car containing garbage. The car is moved down the spur track between the rows of fattening pens and garbage is delivered alternately on both sides. Panels are then lifted, animals are admitted to the feeding sections and before they leave these sections the desired separations from pen to pen are made.

There is an advantage in having the feeding floors of the fattening pens in a continuous concrete paving, because here a maximum of waste and refuse is left by the animals which are not so hungry as the younger, growing stock. After the hogs have left the feeding floor the first operation in cleaning up is to run a V-plow along either side, thus scraping the refuse out into the center of the floor and piling it up in a long, low mound. Then follows a fresno scraper, moving the refuse down to the alley-ways, 20 ft. wide, which occur at 320-ft. intervals. Finally the refuse is shoveled by hand into dump wagons.

GARBAGE FEEDING SCHEDULE AT THE FONTANA FARM

Weight of Hogs, lbs.	Garbage per Head per Day lbs.	Number of Hogs per Pen
65 to 85	12	135
85 to 110	15	110
110 to 140	20	80
140 to 175	25	65
175 to 215	30	55



FARROWING PENS AND WEANING PENS

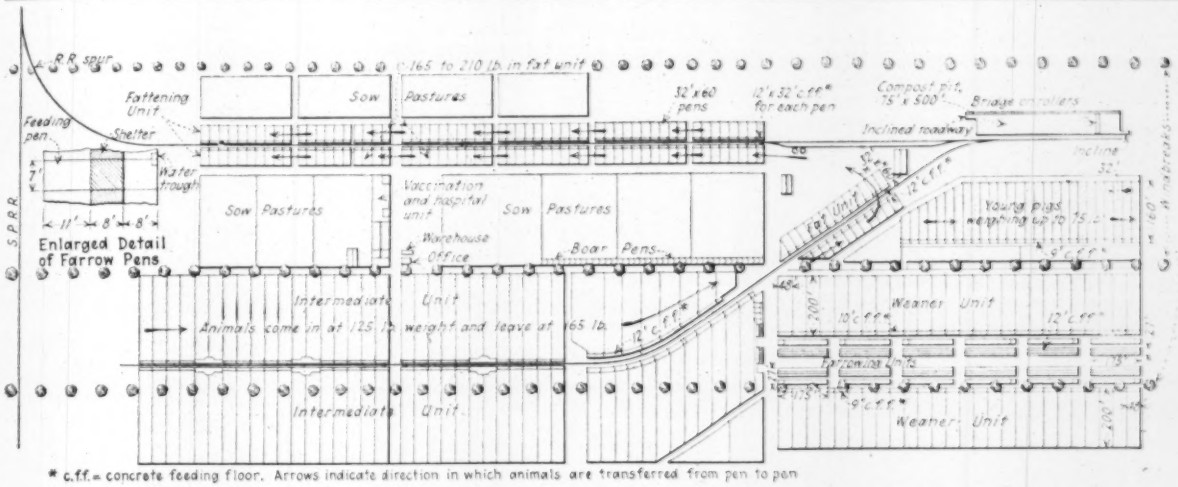
The battery of farrowing pens consists of a shelter in the center with feeding floor at left, and "sun parlor" with watering trough at right. At the extreme right in the upper part of the view is a duplicate farrowing unit and at the extreme left a weaner unit.

A combination scraper and bucket elevator is now in process of development which is expected to speed up and facilitate the handling of this refuse in all pens that have a continuous row of feeding floors. This is one of the most troublesome and costly features in the operation of the farm and a mechanical means of doing this work is highly desirable.

Where garbage is shoveled to the feeding floors by hand, the wagons used have specially built bodies with edges that overhang the fences by 11 in., thus all garbage falls inside the fence and is not left along the roadway or in the fence to sour.

The locomotive crane does all the switching in the plant and can handle 4 to 6 steel gondola cars in a train. These cars, which normally carry 37 to 40 tons of garbage per car, have now been in this service for some 3½ years and are still in good condition. Gondolas, wagons and all other containers used in the handling of garbage are cleaned by live steam jets daily.

The amount of garbage fed at the three Fontana plants last year (see table and curves) as shown by railroad weights, totaled 135,740 tons and averaged 371 tons a day for the 366 days of the year. The total amount of waste or refuse per day is about 125 tons or about 35 per cent of the weighage. Of this 80 tons daily represents the cleanup on the feeding floors (including garbage left there) and 40 to 45 tons is taken from back floors and pasture; the latter is made up largely of peat, manure and pig-house bedding. That is, the pigs eat much more than 35 per cent of the weighage. Before the cleanup from the feeding floors all bottles, cans and other foreign material are separately gathered up by hand. Although a Los Angeles city ordinance forbids putting these things in garbage



ARRANGEMENT OF PENS AND ROUTING OF PIGS IN MAIN SECTION OF FONTANA GARBAGE FEEDING FARM
As high as 40,000 pigs are sometimes utilized for the disposal of the garbage of Los Angeles.

cans and although there is not a great deal of it, still provision has to be made for removing the occasional "contraband." Bones are also picked up and are kept separately to be ground up for fertilizer.

The cleanup is taken to the compost pit, a concrete-lined excavation 500 ft. long and 12 ft. deep whose width varies from 55 ft. at the bottom to 75 ft. at the top. This pit is spanned by a 75-ft. steel girder bridge with a capacity of 15 tons from which the wagons dump the refuse into the pit. The bridge is mounted on wheels running on rails along the inside of the pit walls at a level low enough to bring the surface of the bridge flush with the top of the wall. As the pit is filled the bridge is moved ahead with pinch bars. As the bridge is moved, the portion of the pit just filled is leveled off and covered with a 4- to 6-in. layer of ground peat and gypsum. On this a mixture of distillate and oil of myrbane is sprayed to kill flies that might otherwise be attracted to the pit as a breeding ground. This spray has been found very effective and in addition to being a fly repellent, kills flies that are brought in contact with it.

The bottom of the compost pit slopes toward the center whence drains lead to the sewer. When the refuse goes into the pit it has a moisture content of about 75 per cent. This is reduced by drainage to about 50 per cent moisture. Driers which are still to be installed are expected to reduce the moisture content to about 10 per cent. The nitrogen content of refuse in the pit is kept high by the prevention of ammonia evaporation through the peat covering. Temperatures in the covered mass in the compost pit are said to be quite high—at least high enough to kill germs.

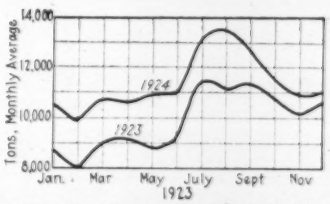
LOS ANGELES GARBAGE COLLECTIONS IN 1924

Month	Pounds per Month	Tons per Month	Average Tons per Day
January	20,931,840	10,466	337
February	19,593,870	9,796	337
March	21,474,470	10,737	346
April	21,157,400	10,578	352
May	21,708,470	10,858	350
June	21,835,720	10,918	363
July	26,234,868	13,167	424
August	27,089,740	13,545	437
September	25,550,470	12,775	426
October	23,151,030	11,575	373
November	20,788,080	10,394	346
December	21,965,400	10,983	354
Averages	22,623,446	11,312	371

Total for year, 271,481,350 lbs., or 135,740 tons.

The proposed plan of operation of this pit is to install a dragline near the center, and take out the composted material after about four months of digestion, pass it through driers and then grind it up for fertilizer. For the present, pending installation of the drying and grinding plant, removal from the pit is being made by truck, loading with shovels from depressed roadways to openings in the concrete wall at either end of the pit.

Final disposition of refuse taken from this pit is made on the lands of the Fontana Farms Co., which owns some 14,000 acres, including extensive orchards and vineyards near the hog farm. Until recently the refuse has had to be spread and covered in the orchards in a more or less raw state. This was accomplished by hauling it in steel dump trucks to the groves where it was dumped and then reloaded into spreaders, thus necessitating a rehandling. With the compost pit in operation, especially when supplemented with drying and grinding plants, final disposition will be simplified. It is even expected that the dried and ground product can be left uncovered in the orchards without any objectionable results.



SEASONAL VARIATION IN TONNAGE OF LOS ANGELES GARBAGE

Peat for use in the compost pit and also for covering concrete floors is taken from an old swamp nearby and ground up in a portable grinder. Shavings are brought in carload lots from the planing mills and are unloaded by blower to a warehouse built for this purpose close to a railroad spur.

The only exception to the exclusive use of garbage for feeding the hogs is in the case of brood sows that get special food in the 36 hours after farrowing. This consists of a mixture made up of 45 per cent barley, 45 per cent middlings and 10 per cent "semi-solids" (a casein product) to which water is added to secure the desired consistency.

The increase in weight of the hogs varies from 40

to 80 lb. per ton of garbage, according to time of year, quality of garbage, and condition of the animals. Ordinarily the expected increase is a gain of ½ lb. per day up to a weight of 100 lb. after which the gain should be about ¾ lb. per day up to a weight of 150 lb. and thereafter a gain of 1 lb. per day. The average quantity of garbage fed on the entire farm is about 19 lb. per head per day. Obviously the rate is higher in the fattening pens and lower in the weaning pens. A classification of the feeding schedule and the number of animals to a pen, as Fontana experience has shown to be desirable, is given in the accompanying table.

On the Fontana farm it is considered necessary to raise hogs on garbage for two or three generations before securing the stock best adapted to garbage feeding. The experience has been that grain-fed pigs brought to the garbage farm never do as well as pigs raised from garbage-fed stock and, moreover, are much more liable to disease when put on a garbage ration. This is ascribed to the fact that only after several generations of garbage feeding do the animals develop the large intestinal capacity necessary to make the most of a ration consisting exclusively of garbage. The Durco breed is used at Fontana almost exclusively.

The operating crew on the farm consists of about 60 men, a large percentage of whom are Mexicans. These men are divided into squads each reporting to a superintendent in charge of one of the various units, such as sow, weaner, feeder, fattening, crane, cleanup and veterinary.

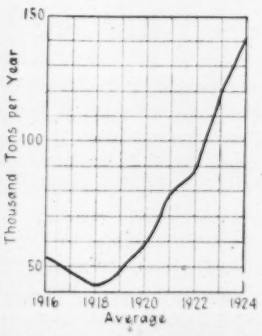
The gutters and drains of the paved areas and the compost pit are connected to a sewer system which empties into a septic tank on the lower end of the farm. The effluent is passed on by gravity for irrigation on areas at still lower levels.

Ventilation of the shelter houses has been found to be very important. There must be neither draft nor excessive heat. For example, an epidemic of pneumonia was stopped by putting louvre type ventilators in the roofs of shelter houses so that hogs did not come out of pens hot with animal heat into cold air. A fly spray is used in all buildings when the cleanup is made and occasionally a creosote spray is applied in shelter houses and in all nooks and corners where flies might lodge. By these means and by frequent washing down of the shelter houses with disinfectant, the fly nuisance is kept down to a minimum, in fact, the number of flies at the pens is less than in most farmyards.

The hog farm, properly speaking, is the livestock department of the Fontana Farms Co., and is operated under the general direction of A. B. Miller, president; R. E. Boyle is the ranch superintendent. Acknowledgment is made to these officials for information used in the preparation of this article.

COMPOST PIT LOOKING OVER FILLED SECTION

Wagon on bridge has just dumped garbage, which is leveled and covered with ground peat as shown in foreground and at right. This pit is 75x500 ft. in plan, and 12 ft. deep.



INCREASE IN GARBAGE AT LOS ANGELES, 1916-1924

It may be added that for several years some time ago Los Angeles garbage was fed to hogs on a similar but cruder plan and that subsequently the city sold its garbage to a reduction company. Still earlier two or three garbage incinerators were in use successively.

Limit of California Irrigated Area

The value of soil products in California in 1924 was approximately $450,000,000. This included the production of both irrigated and unirrigated land and included 6,000,000 acres of the former. Although agriculturists have thus far skimmed the cream of land that may be used for irrigation there is an ultimate limit to the total amount of land in the State for which there will be sufficient irrigation water. Various estimates place this total area from 12 to 18 million acres, which it is estimated should produce a crop with at present price levels about one billion dollars. The development of water for irrigation purposes is becoming increasingly expensive and the cost of development per acre is already so high that it is usually feasible to develop only in comparatively large tracts—a fact which is believed to increase the probability that either state or federal aid will be needed in much of the development work yet to be done.

Indianapolis Flood Protection Is Progressing

Program Includes White River Channel Enlargement and East Side Levees to Complete Work Begun in 1915

FLOOD-PROTECTIVE improvement of the White River in Indianapolis is again in progress, after construction of two initial sections of the work in 1915-18. The work is the direct outgrowth of the damage done in the great flood of March-April, 1913. The improvement includes widening and rectification of the channel of the White River and the lower part of its tributary, Fall Creek, and the construction of levees along the banks of the new channel. The location of the works is shown by the accompanying map.

As indicated by the shaded area in the map, the 1913 flood covered a large area west of the river, west and southwest of the center of the city. Protection of this area was considered of greatest urgency, and the first protective works were built along the west bank.

In the study of the 1913 flood effects and the possibility of coping with future great floods, a complete drainage-area survey of the White River was made, and the maximum flow at Indianapolis was fixed at 120,000 sec.-ft. This represents a runoff of 6 in. in two days, or 3 in. in 24 hr., from the total drainage area of 1,606 sq.mi. above the city.

In the study of means of protecting against such great floods, investigation was made of detention reservoirs, bypasses and river rectification with levees. It was found that the first two methods were not feasible, and rectification and leveeing were adopted. The improved channel was made 650 ft. wide and 29 ft. deep, with a freeboard of 4 ft. (giving a total depth of 33 ft.) as margin of safety over 1913 conditions.

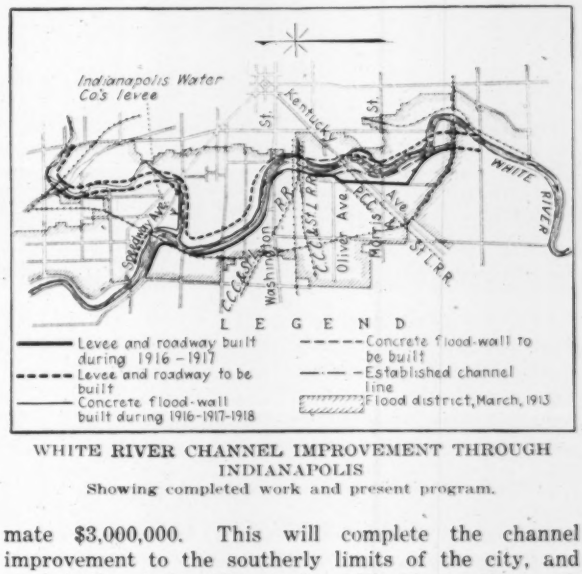
Completed Work—Work in carrying out this project was begun on the west bank in 1915, under contract. The west side levee is 4½ miles long, and is mainly an embankment of 75-ft. top width, 1 on 1½ landside slope and 1 on 2½ riverside slope, with reinforced-concrete revetment at points exposed to wash. A few short sections of retaining wall are included in this length, the wall being built where room was not readily available for levee construction. Valves on sewer and other openings through the embankment and the walls are provided to protect against backwater on rising stage. The west-side work was completed in 1917, at a total cost of $1,417,000, including $759,000 for real estate. Some bridge revision and raising of street grades were included.

A small amount of work along the east side of the stream was done in the two years immediately following the completion of the west side contract, short sections of concrete retaining wall being built on the east bank of White River and the north bank of Fall Creek, at a cost of $247,000. When this work was completed war conditions and the subsequent high cost level and municipal bonding limitations prevented continuation of the work until recently.

Last year the city Board of Public Works decided to resume work on the project for a length of 1 mile in the southwestern part of the city, from Washington to Morris Sts. (see map). This work will cost about $3,000,000, including nearly $500,000 for real estate, $750,000 for concrete retaining walls, $700,000 for channel excavation and levee construction, and $1,000,000 for two bridges.

Contracts for the two bridges were let last spring, and these structures are now nearing completion. One is a seven-span concrete arch bridge on Kentucky Ave., 960 ft. long, with 80-ft. width of deck. The other, on Oliver Ave., is a similar structure of five spans, 650 ft. long. The contract prices are $635,000 and $487,336 respectively. Five railroad bridges in this mile of channel also must be reconstructed, at a cost probably in excess of $2,000,000. Channel and levee work will probably be delayed until these structures are completed.

After this section it is planned to take up the section immediately south, from Morris to Raymond Sts., including two highway bridges and the belt railroad bridge. A cutoff channel to eliminate a sharp bend of the river will be included. The cost will approximate $3,000,000. This will complete the channel improvement to the southerly limits of the city, and work is then to be taken up from Washington St. north and west, a total distance of about 2½ miles, to where high ground makes levee construction unnecessary. With this section the levees along Fall Creek and four highway bridges and one railroad bridge will be built.


Indianapolis Water Co's levee
Kentucky Ave.
WHITE RIVER
Oliver Ave.
Washington St.
L E G E N D
Levee and roadway built during 1916 – 1917
Levee and roadway to be built
Concrete flood-wall built during 1916-1917-1918
Concrete flood-wall to be built
Established channel line
Flood district, March, 1913

WHITE RIVER CHANNEL IMPROVEMENT THROUGH INDIANAPOLIS
Showing completed work and present program.

Maintenance of the levees and adjacent lands acquired in connection with the improvement is in the hands of the Board of Park Commissioners. The west side levee roadway is at present being maintained and used as a parkway.

Work is in charge of the city engineer, Frank C. Lingenfelter, and is under the immediate supervision of H. W. Cassady, deputy city engineer. The cost is distributed between city, county and the benefited land (land subject to overflow) in the proportion 45, 45 and 10 per cent respectively, under a state law of 1915. The city's share of the cost is paid for by 30-year bonds, retired by a tax levy limited to 4c. per $100 of property. In addition, the city's limit of bonded indebtedness, fixed at 5 per cent, must be observed. These requirements control the rate of completing the program. Funds now available within the bond limit make it possible to complete the two-mile sections south of Washington St., while other funds must be looked to for the remainder of the work.

Live-Loads for Building Designs: Recommended Standards

Committee of Department of Commerce Reports Its Conclusions from Floor-Loading Data and Opinions of Experts

BASING on a full study of floor loads in buildings, and utilizing opinions obtained from architects, engineers and building officials, the Building Code Committee of the U. S. Department of Commerce has just issued a final report on floor live-loads for use in building design. The figures recommended in the report are supposed to be minimum loads for the several classes of buildings specified, and it is expected that where the engineer has reason to anticipate heavier loading he will raise the design load correspondingly. The reports of the committee are intended to influence municipal authorities to draft or revise their building codes in such a way as to eliminate the diversity of requirements which now exist among these codes.

The committee states that it believes "that live-loads assumed in designing many types of buildings were largely matters of tradition and had scant scientific basis." It therefore proceeded to gather all precise measurement data on building loads that were obtainable, and secured data particularly through the National Association of Building Owners and Managers, the American Warehouse Association, and other organizations. Elaborate floor load measurements and other data supplied by C. T. Coley (Equitable Building, New York, reported in *Engineering News-Record*, March 23, 1923, p. 584), C. H. Blackall (Boston office buildings), M. W. McIntyre, the Hotels Statler Co., the Turner Construction Co., and others, were used and analyzed. The resulting tentative conclusions were later revised with the aid of discussions received from more than a hundred men engaged in building practice.

In discussing the matter of setting up separate load classes, the committee expresses the view that most building codes have too few load classes, and that "load requirements in many cases are framed to secure buildings strong enough to endure whatever changes of use may occur, whether or not reported to the building officials." The committee believes it to be more economical to establish a larger number of load classes and to depend on adequate supervision and inspection of use of buildings by the municipal building authorities to guard against change of use which would lead to increase of loading. It says that some buildings "are so often subject to overload that a blanket requirement affecting design only, no matter how drastic in nature, is insufficient for safety unless the use of each building is watched." Its resulting attitude is expressed in the following statement: "If floor loads and occupancy changes are controlled throughout the life of the building, it is possible to adopt the policy requiring each building merely to be strong enough for its intended use." It admits, however, that present information is not sufficiently complete to define the floor loads for various occupancies satisfactorily.

Abstracts from the committee's recommendations are:

What Live-Load Covers—Live-load includes all loads except weight of permanent construction and movable partitions. No impact allowance is considered necessary, the recommended live-loads being thought large enough to cover impact.

Floor Live-Loads — Dwellings, hospital rooms and wards, hotel rooms, 40 lb. per sq.ft. (exceptions: In one and two-family dwellings with monolithic or solid or ribbed slab floors, 30 lb. per square foot).

Offices and assembly rooms with fixed seats (churches, schoolrooms, reading rooms, museums, art galleries, and theaters), 50 lb. per sq.ft. (In offices alternative provision is to be made for a 2,000-lb. load on any 2½-ft. square space.)

Public rooms (including aisles, corridors, lobbies), assembly halls without fixed seats, grandstands, theater stages, stairways, and the like, 100 lb. per sq.ft.

Industrial and commercial buildings, design load to be determined by the use intended, with the following minima:

Type of Building	Minimum Design Load, Lb. per Sq.Ft.
General storage	250
Special storage	100
Light manufacturing	75
Printing	100
Wholesale stores (light merchandise)	100
Retail salesrooms (light merchandise)	75
Stables	75
Garages, all types of vehicles	100
Passenger cars only	80
Sidewalks, with alternative concentrated load of 800 lb.	250

Roof Loads—Vertical live-load, 30 lb. per sq.ft. of horizontal projection for slopes of 4 in. or less per horizontal foot; 20 lb. for slopes of 4 in. to 12 in. per foot; no vertical live-load, but 20 lb. normal wind load for steeper slopes.

Girder and Column Loads—Reduction of live-load may be made in designing girders, trusses, columns, piers or walls, and foundations, which carry more than one floor. Where 2, 3, .. 6 floors are carried, the reduction of total live-load may be 10, 20, 30, 40 and 45 per cent; where 7 or more floors are carried, 50 per cent. Footings are to be proportioned for full dead-load plus reduced live-load according to above percentages, with "a further reduction of one-half the live-load as permitted above" in case of buildings for human occupancy (dwellings, office buildings and public buildings).

Wind Pressure—Pressure on all vertical plane surfaces, 10 lb. per sq.ft. below a level of 40 ft. above ground, and 20 lb. per sq.ft. above this level, except that 30 lb. is to be taken on sprinkler tanks, sky signs, and similar exposed structures and their supports. Cylindrical surfaces are to be proportioned for the same pressures on six-tenths of the projected area. Buildings specially exposed are to be designed for 20-lb. wind load on the entire height, in place of 10 and 20 lb.

Control of Loading — In order to give assurance against overloading, it is required that the live-load capacity of each floor of a commercial or industrial building shall be posted, after a certificate has been obtained from the building official; that "the occupant of the building shall be responsible for keeping the actual loads below the certified limits"; and that "adequate measures shall be taken by the building official to insure that these loadings are not exceeded." The floor load capacity must also be shown on file plans (for other than residential buildings). An occupancy permit on completion of the building is to be issued only after the floor load signs have been installed. Revised occupancy permits are required whenever the occupancy of a building is changed.

Working Stresses in Framework of Buildings: Tentative Proposals

Suggested Building Code Provisions Drafted by Committee of Department of Commerce for Criticism

A TENTATIVE draft of building code provisions governing working stresses in materials has just been issued by the Building Code Committee of the Department of Commerce (Ira H. Woolson, Chairman, Department of Commerce, Washington) for criticism and discussion. It deals with timber, steel and concrete. The stress recommendations are of wide interest, being designed for application to building work throughout the country, in agreement with the committee's object to harmonize on a modern basis the now discordant building-code practices of different cities.

From the introductory statement of the report it is to be gathered that the recommendations are based very largely on the expectation that there will frequently be indifferent skill or negligence in the design and construction of buildings, and that there will be only "haphazard municipal control over design, construction and inspection in the present status of building regulation." The report makes it clear that these conditions induced the committee to take a conservative attitude regarding stresses in structural steel and in reinforcing steel, even high carbon reinforcing steel being limited to 16,000 lb. per sq.in. On the other hand, the stresses for reinforced concrete are made variable, according to the mixture used, or in case the concrete used is subjected to test, on the test strength of the concrete.

Timber Construction

In timber design, the allowed working stresses are to be applied to the sum of dead- and live-load stress; for combinations of these stresses with wind, a 50 per cent excess is allowed. Where timber is exposed to the weather all working stresses are to be reduced 25 per cent. Working stresses are listed separately for a large number of varieties of timber, the following sets of values (all given in pounds per square inch) being typical: *Oak*, 1,400 bending, 125 longitudinal shear, 1,000 compression along grain, 500 compression across grain; *Southern yellow pine*, 1,500 bending, 110 longitudinal shear, 1,100 compression along grain, 325 compression across grain; *Douglas fir*, 1,500 bending, 90 longitudinal shear, 1,100 compression along grain, 325 compression across grain; *Eastern hemlock*, 1,100 bending, 70 longitudinal shear, 700 compression along grain, 300 compresion across grain; *Spruce*, 1,100 bending, 85 longitudinal shear, 800 compression along grain, 250 compression across grain. The values for cross-grain compression may be increased 50 per cent in the case of joists supported on a ribbon board and spiked to the studding.

Column loads are to be based upon the working stress recommended for compression along the grain, this value to be used without reduction for unsupported lengths not greater than 11 times the least width. For lengths from 11 to 22 times the least width, the load per square inch is to be determined by the formula $1.5\,C(1 - 1/33\,l/d)$, in which C is the allowed working stress in compression along the grain, and l and d are unsupported length and least width, in inches. Columns exceeding the ratio 22 are to have their working stress calculated from the formula $\frac{1}{4}E/(L/d)^2$, which represents the Euler formula with a factor of safety of about 4.

Steel Construction

For structural steel two sets of values are fixed, a lower one (16,000-lb. basis) applying to structural steel bought without specifications or according to the A. S. T. M. specifications for Steel for Buildings, and a 12½ per cent higher value (18,000-lb. basis) applicable to A. S. T. M. Steel for Bridges. The specified units apply to live- and dead-load stresses; for wind stresses, or combined wind and load stresses, working stresses may be 25 per cent higher (as against 50 per cent higher in the case of timber).

For the lower grade of steel the following values are specified:

Kind of Stress	Working Stress, Lb. per Sq.In.
Tension	16,000
Compression, maximum on short columns	12,500
Bending stress in beams	16,000
In pins	24,000
Web shear, gross section	10,000
Shear in shop rivets and pins	12,000
In field rivets and rough bolts	9,000
Bearing on shop rivets, pins and faced surfaces	24,000
On field rivets and rough bolts	18,000

In proportioning columns the basic maximum stress is to be used up to a length-ratio (l/r) of about 60, beyond which the formula $16,000 - 60\,l/r$ "or some equivalent expression" is to apply. Columns may be used up to a length-ratio of 160.

Compression flanges of beams must be proportioned for a reduced stress, $19,600 - 240\,l/b$, when the length between lateral supports exceeds 15 times the breadth of the flange, and in any event lateral supports are to be provided not farther apart than 40 times the breadth. Web shear, for which the maximum on gross section is 10,000 lb. per sq.in., must also be determined with regard to distance between flanges or distance between stiffeners, d, in relation to the web thickness, t, by the formula $12,000 - 40\,d/t$.

A special allowance is made for columns subjected to flexure due to lateral bending in addition to their longitudinal load. It is provided that the combined stress may be as high as the allowed stress in bending (16,000) while the axial stress alone must not exceed that allowed for columns (12,500 maximum).

As already stated, bridge-grade steel throughout is to be used with stresses 12½ per cent higher than those cited, making the basic value for tension and bending 18,000 lb. per sq.in. and the maximum column stress about 14,000.

Concrete Construction

The concrete stress recommendations, it is stated, are largely based on those of the Joint Committee on Specifications for Concrete and Reinforced Concrete.

For direct compression, the maximum stress is fixed at 0.25 per cent of the ultimate compressive strength of the concrete. For bending, the extreme-fiber stress in compression may go up to 0.40 of the compressive strength of the concrete. Shear and bond are limited to 0.02 and 0.04 per cent of compressive strength (0.05 bond for deformed bars). Compressive strength is to be determined by tests; where there are no tests, the following values may be used for mixtures as stated

(ratio of cement volume to sum of separate volumes of aggregate):

Mixture	Ultimate Compressive Strength, Lb. per Sq.In.
Plastic Mass Concrete	
1 to 6	2,000
1 to 4½	2,500
1 to 3½	3,000
Reinforced Concrete Mixed Moderately Wet	
1 to 6	1,500
1 to 4½	2,000
1 to 3½	2,500
1 to 2½	3,000

Tensile and compressive stresses in reinforcing steel are to be limited to 16,000 lb. per sq.in., and the tension is to be computed without any allowance for tension in the concrete.

The recommendations are followed by a long appendix giving the views of the committee and reasons for many of the recommendations. It contains the statement that "the Building Code Committee believes that every building code should be printed with an appendix containing sufficient explanation of the code requirements to make them easily understandable."

From Filters to Small Wells Then to Large Wells

How Montgomery, Ala., Arrived at a Large-Capacity Deep-Well Supply Pumped Electrically and at Reduced Cost

By W. A. Cone
City Engineer, Montgomery, Ala.

FORCED by pollution of a river water to wells of small bore with air lifts and then by depletion to those of larger bore with centrifugal pumps, Montgomery, Ala., now enjoys an adequate supply at less cost than ever before.

Many years ago Montgomery secured its supply from the Alabama River. A sand and gravel filter in conjunction with a settling basin, furnished a clear water. Steam-operated, slow-speed suction pumps forced the water from a concrete pit 15 ft. in diameter and 60 ft. deep into the city mains. As the cities and towns along the Alabama River grew in size and the many manufacturing plants sprang up it was necessary to use the river to carry off the majority of sewage and waste. The water became so polluted it was not fit to drink. The gravel filter in the river was enlarged and improved but even at that the water was so contaminated that it was entirely unsatisfactory.

With an adequate source of pure water in mind extensive geological surveys were made. Of the three water-bearing formations found, the first was 200 ft. from the surface, the second 400 ft. and the third 600 ft. The first wells were drilled to the 200-ft. stratum and as later wells were put down, a few were drilled to the 400- and others to the 600-ft. stratum.

Electric Pumping—Practically the only method in use at that time for securing large quantities of water from wells was the air-lift system, operated by steam-driven air compressors, as electricity was not developed to its present commercial state. From four 2,148,000-gal. receiving reservoirs the water was pumped into the city mains by a steam booster pump. The property and equipment of the water department then consisted of several acres of land for the wells and reservoirs, a large brick building, two steam-driven air compressors, two steam booster pumps, four boilers and miscellaneous equipment. To operate the plant required the services of a night and day shift of engineers, fireman, oilers and helpers. The expense involved was considerably more than the pumping cost in securing the water from the river, but the water was of such excellent quality that the increase was compensated for by the complete satisfaction of the public.

As an inducement to secure new business, the Montgomery Light & Power Co. in 1911 agreed to furnish the city water-works with electrical power at a flat rate of $14,500 a year, regardless of the amount of power used. Further, the power company agreed to keep half pressure in the boilers so in case the electricity failed they could start up the steam equipment. This was

PUMP HOUSE OVER ONE OF THE NEW WELLS AT MONTGOMERY, ALA.

very necessary as the electrical equipment was then in such an experimental stage that frequently the generators would be shut down for two weeks at a time.

Therefore, in 1911 the city of Montgomery changed from steam to electric drive in their water-works plant. Two air compressors were purchased, each capable of delivering 3,000 cu.ft. of air per minute at 60 lb. pressure, and directly connected to a 450-hp. motor. One compressor was sufficient to pump the water so that one was used as a standby unit. To make the electrification complete two horizontal centrifugal units replaced the steam booster pumps. Each horizontal pump was driven by a 300-hp. motor and was designed to deliver 4 m.g.d. from the reservoirs to the mains at 70 lb. pressure.

By 1920 the city's Water Department had 18 wells in use. These wells, distributed within a radius of 2,000 ft. of the power house, were piped into the five reservoirs—a fifth reservoir having been built in the meantime. To give additional storage and more constant head two tanks were built, each of 1,000 gal. capacity, 260 ft. high and 75 ft. in diameter.

From 1911 to 1921 the power rate, about 0.2c. per kw.-hr., was undoubtedly the lowest in existence. But in 1921 conditions changed. The Montgomery Light &

Power Co. went into the hands of a receiver and the contract was canceled. It was then necessary to pay at the rate of 1c. per kw.-hr. plus the demand charge which approximated 1½c. more. This charge was fixed and authorized by the Alabama Public Service Commission. With this increased rate the power bill immediately jumped from $14,500 to $70,000 a year. This bill was so excessive it was decided to find out if there were not a more efficient and economical way to obtain the water.

A survey made in 1915 showed the well production was 4.6 m.g.d., while in 1918 it had dropped to 3.7 m.g.d. Since the existing supply was being used more rapidly than it was being replenished it was deemed best not to drill additional wells in that locality. The site selected for the new wells was a mile away from the power house. In order to use the air-lift system on these wells it would have required a new air compressor and motor, as the existing air compressors were then working to capacity, a mile of air line from the power house to the wells, a reservoir and booster pump, poor and expensive engineering.

In 1921 detailed efficiency tests were made on the air-lift equipment and two deep-well centrifugal units at the new site. Due to the low power cost the air-lift equipment had not been given careful attention and the overall efficiency (from electrical input to water output) was 10.6 per cent; the efficiency on the deep-well centrifugal pumps and motors was 60 per cent.

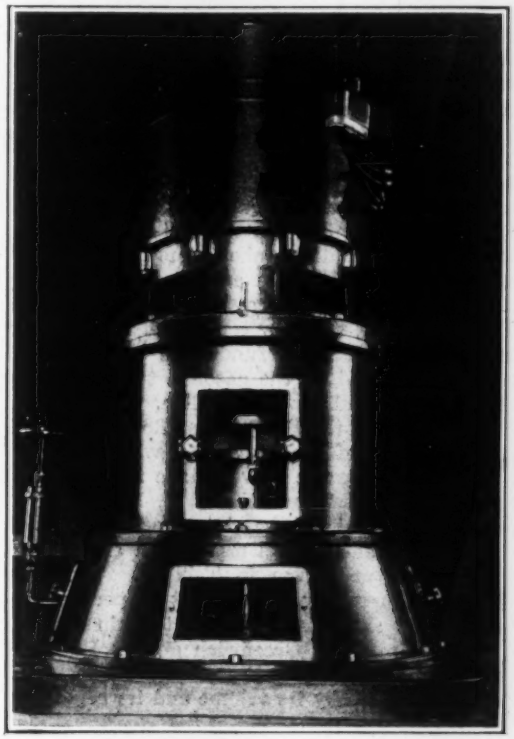
New Wells—A contract was let to the Layne & Bowler Co. for a plant to provide 4 m.g.d. to be delivered into the surface reservoirs for $110,000. The company was required to drill at least four wells and as many more wells as might be necessary to produce the quantity agreed upon.

The old air-lift wells were 6 in. in diameter; ten of the wells were drilled to the 400-ft. stratum, five drilled to the 200-ft. and three to the 600-ft. stratum. Inside the 6-in. hole was placed a 6-in. brass strainer 50 ft. high. The horizontal slit openings in this type of screen allowed the water to pass through into the well but held the sand back. The sand was immediately against the screen. The openings gradually filled up with sand. The reception area offered to the water by this brass strainer was 3 sq.ft. per well.

The new wells were drilled with a 24-in. hole through the water-bearing formation to a solid stratum. Inside the hole and extending to the water-bearing formation was a 24-in. solid casing. Inside the 24-in. casing and reaching from the surface of the ground to the hard clay at the bottom of the well, was placed an 18-in. caisson. The upper part of this caisson was of 18-in. solid copperized iron and the lower 40 ft. was made of shutter screen. The bottom of the shutter screen was attached to a truncated cone which gave a larger opening for the water to enter the well.

Between the 24-in. casing and the 18-in inside casing was an intervening concentric space of 3 in. into which was fed a predetermined size of gravel. As soon as the above material was set in place a plunger or agitator was moved up and down in the well in order to loosen all the sand and mud immediately outside the screen. After this a test pump was placed in the hole and the water and sand pumped out violently; as the sand was pumped out the gravel was fed in from the top. After a pumping and feeding process of several hours a complete gravel wall surrounded the screen to a very appreciable distance. The point of separation between the water and the sand in the latter case was not the screen, but the gravel. The area of separation is the circumference of the gravel-wall well which in this case was approximately 40 in. in diameter.

With a height of 40 ft. the reception area is approximately 252 sq.ft. as compared with 13 sq.ft. in the brass strainer. This is made on the assumption that the



INTERIOR OF ONE OF MONTGOMERY PUMP HOUSES WITH VERTICAL CENTRIFUGAL PUMP OVER WELLS

openings in the brass strainer are 20 per cent of the screen and the openings in the gravel approximately 60 per cent. Five wells were drilled in order to meet the guaranteed capacity of 4 m.g.d.

On test the amount of water delivered into reservoirs was 4.16 m.g.d. Figuring power at 1½c. per kw.-hr., the cost of pumping from the wells into the reservoirs was 0.9c. per 1,000 gal. To pump from the reservoirs into the mains by the high-pressure centrifugal pumps, the cost per 1,000 gal. was 1.23c. or a total of 2.13c. per 1,000 gal. to pump from the wells into the mains. By the former air-lift system it cost 2.58c. per 1,000 gal. to pump from the wells to the reservoirs; the cost from the reservoirs to the mains was unchanged, thereby making a total pumping cost of 3.81c. per 1,000 gal. The difference represented in a year's time is equivalent to $35,000. This saving in three years is equivalent to the cost of the new equipment.

Reinforced Concrete in Rheims Cathedral

The nave of the cathedral of Notre Dame de Rheims is to have its roof reconstructed in reinforced concrete, replacing the fifteenth century wooden roof and supports which were destroyed by the great fire resulting from the attack of German incendiary bombs in September, 1914.

Reconstructing Boston Post Road Thirty-Six Feet Wide

Widening, Line Rectification and Four-Track Concrete Pavement Converts Fifty Miles of Boston Post Road, Connecticut Section, into Superhighway for Heavy Trunk-Line Traffic

FIFTY miles of four-way road costing four-and-a-half million dollars are being built for trunk-line traffic between the New York state line and New Haven by the Connecticut Highway Department. The historic Boston Post Road is being reconstructed to provide this trunk line. The old road grade is being cut down, kinks are being taken out and new cutoffs are being built but chiefly the right-of-way is being widened to provide for a 36-ft. concrete pavement or four 9-ft. paved tracks for vehicles. This is probably the longest stretch of paved road of equal width under actual construction in the United States. It is being constructed as a series of operations, about a million dollars being spent each year, but it is anticipated that five years from the time, two years ago, when work was begun, will see the work virtually completed. And the cost is being met from current funds and largely the funds are being provided by the gasoline tax of 1c. a gallon prior to July 1, and now 2c. a gallon.

That portion of the Boston Post Road which is being improved is one of the heaviest traveled roads of the country. In the traffic survey made in 1922-23 by the State of Connecticut and the U. S. Bureau of Public Roads it stood out on the state traffic map as shown by Fig. 1. Traffic counts made then and selected as representative are given in Table I. The increases over these figures have been about 20 per cent a year. On July 2, 3 and 4, with this article in view, traffic counts were made at Greenwich and at Darien. The counts for 24 hours are indicated in Table II.

This traffic both by its volume and its regularity and by its high annual increase makes clear the growing inability of an 18-ft. road to give it accommodation.

TABLE II—TRAFFIC COUNT FOR 24 HOURS

Date	Greenwich	Darien
1925		
July 2	10,037	6,324
July 3	16,137	12,276
July 4	12,043*	No count

*For twelve hours daily.

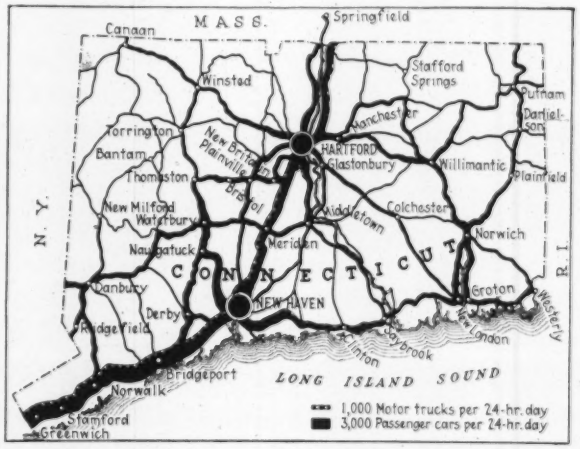


FIG. 1—AVERAGE DAILY CONNECTICUT TRAFFIC

This chart is based on counts made in 1922 and 1923 by the State Highway Commission and the Bureau of Public Roads. Later counts show a traffic increase of about 20 per cent a year.

TABLE I—REPRESENTATIVE TRAFFIC COUNTS ON THE BOSTON POST ROAD

Day	Date	Hours	Weather	Passenger Cars East	Passenger Cars West	Passenger Cars Total	Trucks East	Trucks West	Trucks Total	Grand Total	Remarks
			GREENWICH STATION								
	1922	A. M. P. M.									
Saturday,	September 16	6 – 3	.....			,,718			345	2,063	.....
Tuesday,	October 31	9 – 6	.....	917	912	1,829	278	326	604	2,433	.....
Saturday,	November 11	8 – 5	.....	1,642	1,610	3,252	356	307	663	3,915	.....
Saturday,	December 23	8 – 5	Clear	1,257	1,213	2,470	241	238	479	2,949	.....
	1923										
Tuesday	February 6	8-11 12-5	Clear	373	378	751	181	171	352	1,103	.....
Saturday,	February 17	8-11 12-5	Clear	314	295	609	157	144	301	910	.....
Tuesday,	April 3	8-11 12-5	Clear	749	706	1,455	239	229	468	1,923	.....
Saturday,	April 15	9-12 1-5	Cloudy and Rain	1,124	1,142	2,266	45	41	86	2,352	7 hours
Tuesday,	May 29	9-11 2-6	Clear	1,041	1,002	2,043	227	211	438	2,481	.....
Tuesday,	June 12	11-2 3-8	Clear	1,286	1,123	2,409	311	313	624	3,033	.....
Friday,	July 27	11-2 3-8	Clear	1,398	1,136	2,354	272	243	515	3,049	.....
Sunday,	August 26	6-11 12-5	Clear	....	....	....	51	57	108	....	Pass. records lost
Night following											
	1923	P. M. A. M.									
	June 12	8 – 6	Clear	351	278	629	104	117	221	850	.....
	July 27	8 – 6	Clear	652	593	1,245	82	68	150	1,395	.....
	August 31	6 – 6	Clear	1,647	1,442	3,089	177	132	309	3,398	.....
			BRIDGEPORT STATION								
	1922	A. M. P. M.									
Friday,	October 20	6 – 3	.....	889	922	1,811	203	296	499	2,310	.....
Monday,	November 13	8 – 5	.....	1,022	1,088	2,110	157	183	340	2,450	.....
Friday,	December 15	8 – 5	.....	618	585	1,203	255	211	466	1,669	.....
Monday,	December 25	.....	.....	....	....	....	....	....	....	....	No work Christmas
	1923	A. M. P. M.									
Friday,	January 26	8 – 5	Clear	405	451	906	142	133	275	1,181	Dinner 11-2
Monday,	February 19	8-12 1-5	Clear	348	332	680	130	132	262	942	.....
Friday,	March 23	8-11 12-5	Clear	639	661	1,300	158	147	305	1,605	.....
Tuesday,	April 17	10-12 1-7	Clear	997	904	1,901	301	199	500	2,401	.....
Monday,	May 28	10-1 2-7	Clear	1,171	1,134	2,275	237	182	419	2,694	.....
Thursday,	June 14	7-11 12-4	Clear	924	1,024	1,948	226	290	516	2,464	.....
Thursday,	July 26	7-11 12-4	Clear	870	734	1,604	158	204	362	1,966	.....
Saturday,	August 28	7-11 1-6	Clear	....	....	....	199	133	332	....	Pass. record lost
Night following											
	1923	P. M. A. M.									
	April 17	7 – 6	Clear	535	426	961	121	139	260	1,221	.....

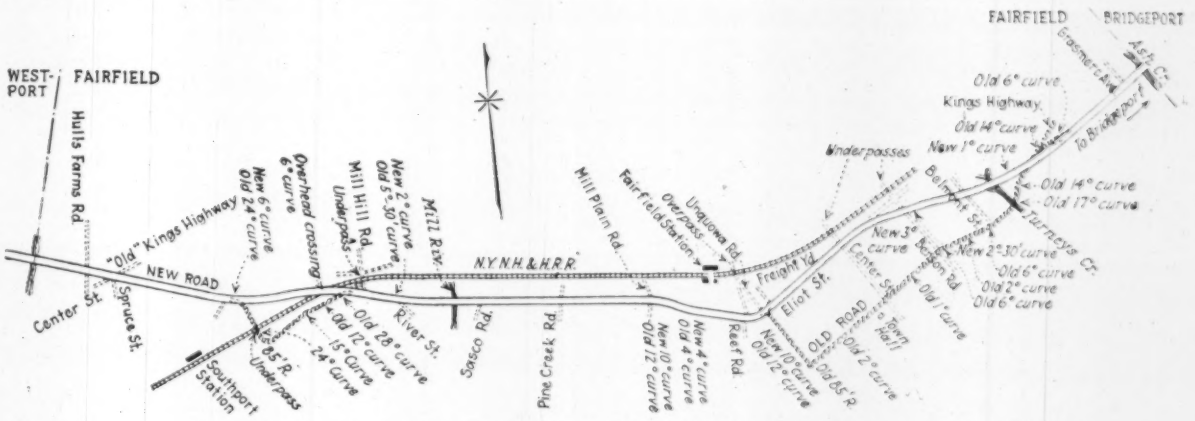


FIG. 2—LINE RECTIFICATION ON BOSTON POST ROAD
Note the flattening out of curves where the new line keeps to the old right-of-way as well as the elimination of bad kinks in the old route.

There had to be more trackways. How best to provide them was a complex question.

Alternate plans of doubling the width of the old road and of building a parallel road 5 or 10 miles off the old road were considered. At first thought, the parallel route seemed to be the ideal plan. Various things had, however, to be taken into consideration. Any road of such magnitude built with current revenue had to be several years in the building. Until completed it gave little through traffic relief because travel must get on and off by inadequate lateral roads. By widening the old road, however, each widened section added to the accommodations—though some of the old narrow road remained there were at least "fast" sections where high and low speed vehicles could sort themselves out. Again a new road back 5 or 10 miles cut through rich estates of people who had moved back to be off the main line of travel. They objected to the new road and moreover they set a pretty price on land for right-of-way—a strip 100 to 120 ft. wide. Much of this cost and opposition was avoided by the alternate widening plan. As it also gave more immediate relief to traffic congestion it was adopted.

Nevertheless widening the old road was a major operation both financially and constructionally. The road is through the famous shore district—a settlement of rich residential, resort and manufacturing towns and cities merging almost into each others' boundaries. Land is astonishingly high-priced. Widening called for more land, the taking down of rows of great trees, the moving back of costly walls and fences, the disturbing of property rights which had endured since the time of the Pilgrims.

In addition to the widening there were places where old kinks in the road must be removed by buying land for a new line. Some of this rectification of line is indicated by the map, Fig. 2, showing the improvement through the towns of Westport and Fairfield. Line changes and widening are in a word costly in property damages and construction before any surfacing costs enter. A study of the views is a help in appreciating this fact.

A high type of construction for the new road was logical. As Table I indicates, a quarter to a third of the vehicles using the roads are trucks and some are heavy trucks carrying factory products to New York. Whole trains of trucks are run nightly by some of the factories or by general trucking concerns. A stiff road is required to carry this traffic and it is provided by a 9-in. uniform depth reinforced-concrete pavement laid on a broken stone or gravel sub-base. An example of the sub-base work is shown by Fig. 3 which is a part of the operation illustrated by Fig. 4. This is an 18-in. layer of broken stone. The pavement construction is

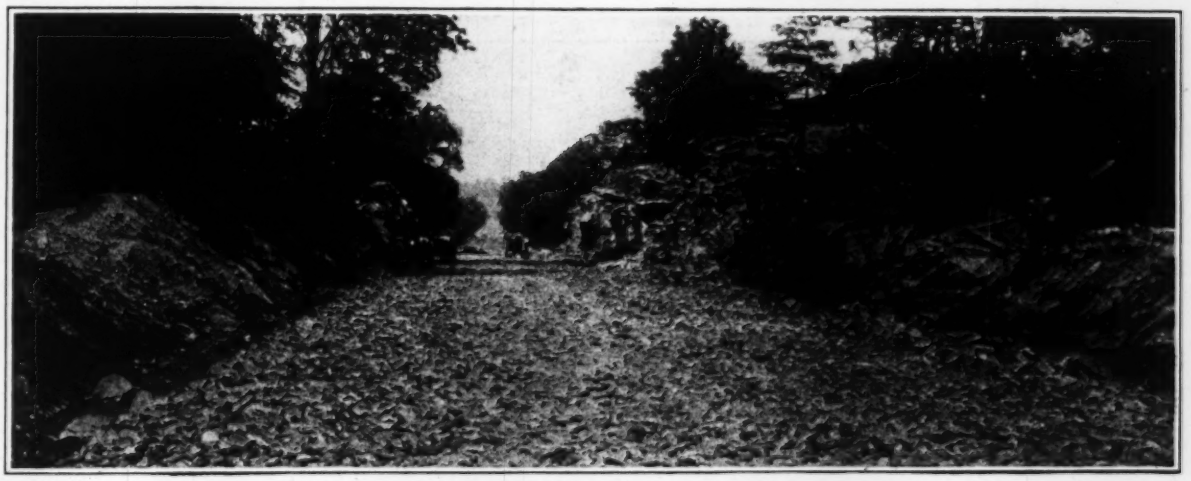


FIG. 3—SUB-BASE FOR REINFORCED-CONCRETE PAVEMENT
This 18-in. stone fill is on the rock floor of a rock cut near Greenwich. Similar sub-base of stone or gravel is used under all new pavement.

shown by the drawings of Fig. 5 and the views Fig. 6 and Fig. 7.

The design it will be noted calls for a slab construction with transverse joints and normally three longitudinal joints making four slabs across the road. Each slab is reinforced top and bottom with edge and corner bars. Where street railways are, the pavement is made three slabs wide and only the outside slabs are reinforced. A 1:2:3 concrete mixed 1½ minutes to a fairly stiff consistency is required. The workmanship requirements are generally high and are strictly maintained. Ordinarily common portland cement is used but where quick road opening is important or other good reasons exist for rapid hardening considerable use has been made of alumina cement. Such places are between trolley tracks, at intersections, at entrances to garages and

FIG. 4—ROCK-CUT LINE RECTIFICATION NEAR GREENWICH
Note the loop to the right of the old route and the new straight route through the cut.

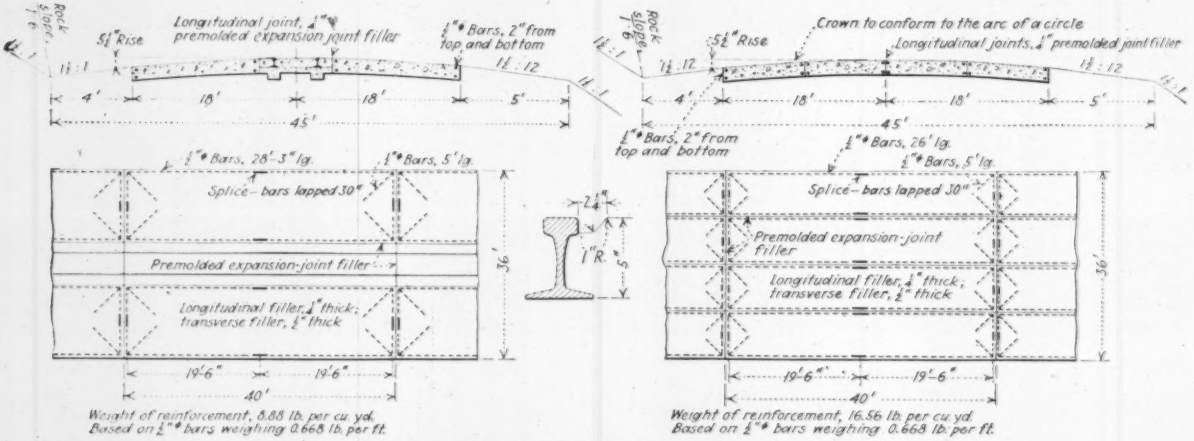

Rock slope 1 to 1
5½" Rise
Longitudinal joint, ½" premolded expansion joint filler
½" ϕ Bars, 2" from top and bottom
1½ : 1
1½ : 12
4'
18'
18'
5'
45'
½" ϕ Bars, 28'-3" lg.
½" ϕ Bars, 5' lg.
Splice – bars lapped 30"
Premolded expansion-joint filler
Longitudinal filler, ½" thick; transverse filler, ½" thick
36'
19'-6"
19'-6"
40'
Weight of reinforcement, 8.88 lb. per cu. yd.
Based on ½" ϕ bars weighing 0.668 lb. per ft.
2¼"
7" R.
5"
Crown to conform to the arc of a circle
Longitudinal joints, ½" premolded joint filler
½" ϕ Bars, 26' lg.
Premolded expansion-joint filler
Longitudinal filler, ½" thick; transverse filler, ½" thick
Weight of reinforcement, 16.56 lb. per cu. yd.
Based on ½" ϕ bars weighing 0.668 lb. per ft.

FIG. 5—STANDARD 36-FT. REINFORCED-CONCRETE PAVEMENT
Note the construction in three or four longitudinal strips with transverse joints every 40 ft. Each 9x40-ft. slab separately reinforced.

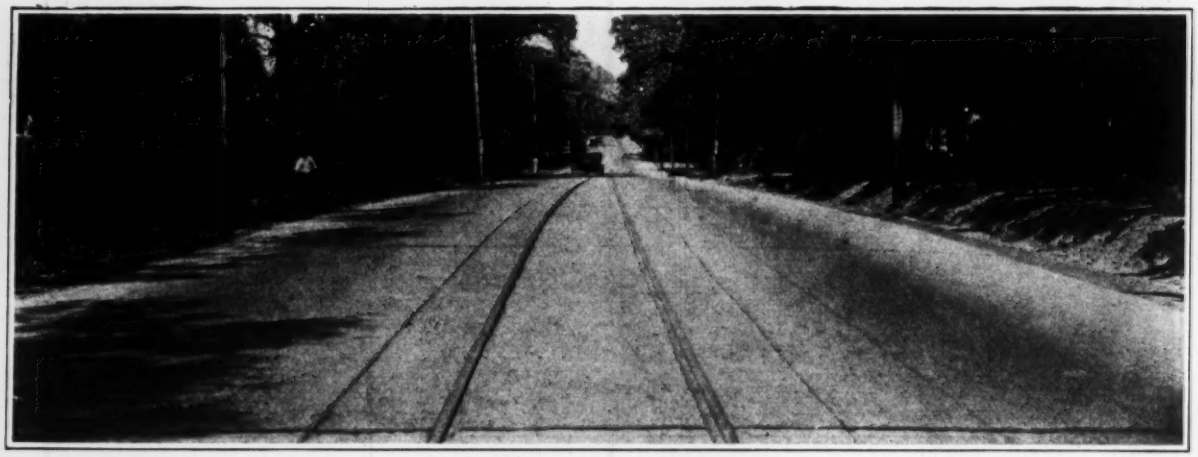


FIG. 6—STANDARD CONCRETE PAVEMENT WITH STREET RAILWAY
Note the longitudinal joint 2 ft. outside of track rails making a three strip pavement.

in underpasses. The experience with the special cement in order to put sections into service quickly has been generally satisfactory.

Reconstruction of the road, as stated, is being carried on in sections, the places where physical and traffic conditions are the worst being first improved. The following sections put under contract or completed since work was begun in 1924 indicate the work done and the costs:

The Puts Hill, Greenwich: This contract covered the construction of 3,436 ft. of concrete pavement and 530 ft. of brick pavement. The width of the state section was 22 ft. and the cost was $128,613.75. The original grade on this hill was 10.5 per cent. The reconstruction cut this to 8 per cent for a short distance and for the balance the maximum grade is under 7 per cent.

FIG. 7—STANDARD CONCRETE FOUR-STRIP PAVEMENT
This road in Greenwich has concrete gutters built by the town giving a curb to curb road.

Byram River, East Greenwich: Work is now under way on a section 5,458 ft. long starting at the state line. This work is to consist of grading and drainage only, the surface being placed at a later date after the fills have settled. This surface will be 36 ft. wide. The cost of this work is now estimated at $151,200.

In Darien: The work done under this contract consisted in constructing 16,300 lin.ft. of 9-in. uniform depth reinforced-concrete pavement, 36 ft. wide at a cost of $305,855.47.

Milford to New Haven: The work being done under this contract consists of the necessary grading and drainage work preliminary to constructing a 36-ft. pavement on this section. The length is 34,600 ft. and the estimated cost is $153,900.

In Greenwich: Constructed in 1924; 36-ft. sheet asphalt pavement 5,500 ft. long; the cost of this section was $280,320.

These costs indicate fairly well the range of prices that will prevail throughout the improvement. Exclusive of the parts in cities and not under the care of the highway department the length of Post Road from the state line to New Haven is 45.8 miles. On contracts let so far prices for reinforced-concrete slab run about $10 a cubic yard, for earth excavation about $1.50 and for rock excavation about $4. Cement is furnished by the state.

Improvement of the Boston Post Road is under the direction of the Connecticut Highway Commission, John A. Macdonald, commissioner; E. C. Welden, deputy commissioner and engineer in charge of construction, and A. W. Bushell, division engineer.

Failure to Clean Bottom Results in Defective Pier Bases

BRIDGE piers built in the Columbia River in 1910 by the open cofferdam method were recently found to be in such defective condition that renewal of the superstructure required building new piers. The case was described by G. H. Trout, bridge engineer of the Union Pacific System, before the American Railway Bridge and Building Association.

In 1910 the North Coast Railroad Co. built a bridge over the Columbia River near Kennewick, Wash., comprising ten Howe truss spans of 150 to 240 ft. length, built of timber, on concrete piers. The approaches were pile trestles. It was expected that the timber superstructure would have a life of 10 or 12 years. After acquisition of the line by the Oregon-Washington Railroad & Navigation Co., of the Union Pacific System, it was found that this expectation of life was approximately correct. Reconstruction required to be taken in hand in 1921, and was completed in 1924.

The appearance of one of two of the piers was such as to cause doubt as to the old substructure offering a sufficient degree of permanency to warrant its use as a support for new steel, so before attempting to make any studies as to type of superstructure it was decided to make an investigation of the old piers, especially in view of the method used in building that portion below the water surface, a description of which appeared in *Engineering News* of Oct. 5, 1911, as it was known that the bed of the river, which was of an irregular rock formation, had not been cleaned off before placing the concrete, which was deposited through water in an open caisson. These caissons were constructed of a single wall of 12x12-in. timbers, floated into position and sunk by loading with steel rails, after which the concrete was deposited by movable-bottom buckets. Maximum water depth was 32 ft.

Holes were drilled downward through the piers to determine their condition, especially near the bottom. Ten of the piers were drilled, to some distance below the bottom of the concrete. In the case of several piers, the hard concrete was found to be 2 to 4 ft. above the bed of the river, resting on gravel which was confined by the timber caissons, this in turn being protected by riprap. It was concluded that when the concrete was being placed some of the cement was washed out. In addition, pockets of gravel up to 12 in. in size were found at various places in the piers below the water line. The findings were held to show that great care must be used in depositing concrete on irregular bottom through water in an open caisson, especially in swift current, to prevent cement washing out of the concrete. The survival of the piers for 12 years was considered to be in part due to the protection offered by the old caissons and riprap.

While the piers were safe at the time of the examination, they were not considered adequate as permanent supports for an important steel structure. Repairing the piers was not thought feasible, and it was decided to build a new bridge. Pneumatic piers were constructed by the Missouri Valley Bridge & Iron Co.

Pittsburgh Stadium Frame Part Concrete and Part Steel

Slab Overlies Cinder Covering in Cut with Supporting Columns Run Through Coal Deposits to Rock—Drainage Made a Special Study—Stadium Designed as Double-Decker

UNUSUAL foundation procedure, difficulties in reaching the site with construction equipment and material, carefully planned drainage and the fact that it is a combination steel and reinforced-concrete structure make the University of Pittsburgh's stadium, under construction, an interesting study. The site of the stadium is on a hill immediately adjoining the campus. The stadium is an enclosed bowl with an outside major axis of 791 ft. and minor axis of 617 ft. The structure was designed as a double-decker, though only the first deck will be built at this time. The seating capacity will be 70,000 as now built and 100,000 with the second deck. The seating area varies in width from a little over 113 ft. to 137 ft. This was necessitated largely by the topography of the ground, as it was necessary to fit the stadium to a rather restricted area. One advantage, however, appearing in cutting down the width of the seating area at the ends is that the seats that are low and generally undesirable (because of the difficult visibility) at the ends are eliminated. Approximately 150,000 cu.yd. of material were excavated to prepare the site for construction and provide a level playing field. As the stadium is built in the side of a 400-ft. hill near its crest, that portion of it in cut is reinforced concrete laid on the slope and the rest is steel supporting the seat deck.

Materials and Haulage—The problem, therefore, of getting construction equipment and material to the site was a big one. Gravel was purchased from a local concern that dredged from the Allegheny River and trucked from barges to the site. Sand was secured from the same place and handled in the same fashion. The haul was about 2½ miles and the rise from the river to the site about 400 ft. Most of this elevation, however, had to be overcome in the last half mile. Cement and steel were trucked from the railway siding at East Liberty. This represented about a two-mile haul, and 2,200 tons of steel were carried this distance up the steep hill. Sand and gravel were stockpiled in about 2,000-yd. piles and handled into a 180-ton steel bin above the mixer by clamshell.

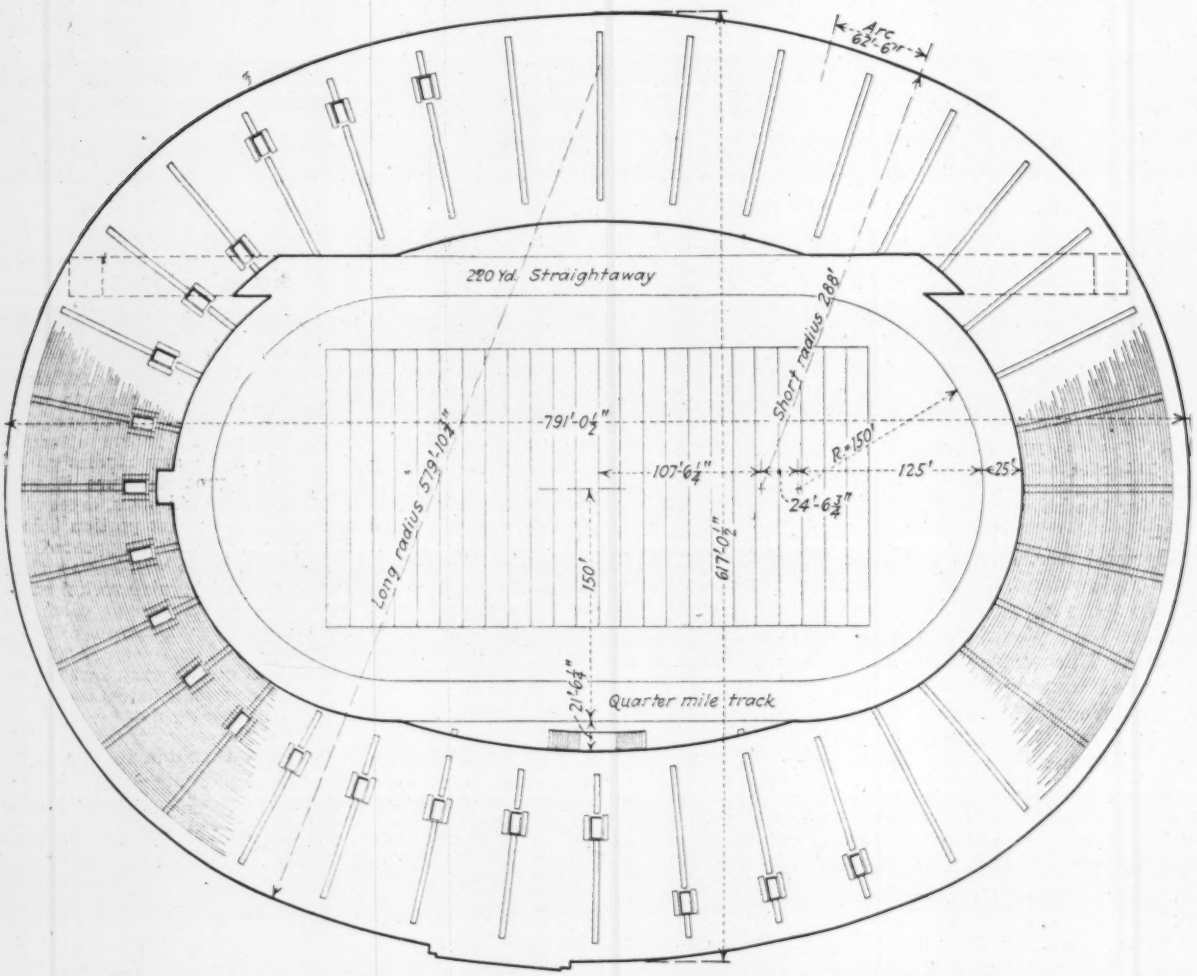


FIG. 1—GENERAL PLAN OF THE UNIVERSITY OF PITTSBURGH STADIUM

Foundation Work—When excavation work was begun on the site, it was discovered that there was considerable coal in the hill. Some of the coal had been taken out and part of this old drift was directly under the deck location. When work was started it was discovered that this coal was burning in several places. Coal outcroppings smoked and in places the coal shale would ignite and smolder if any fires of waste were started in the vicinity. This led to the necessity of providing foundations for the decking of the reinforced-concrete section independent of either the coal or the coal shale overlying solid rock. Accordingly open caissons were carried down from 6 to 60 ft. depending on the location of solid rock and of the columns and structure. Most of these had to be carried through the old drift. In order to provide adequate bearing surface for the steel columns and supporting structure, it was necessary also to carry the foundations down to solid rock. These foundations ran 4 to 40 ft. below ground.

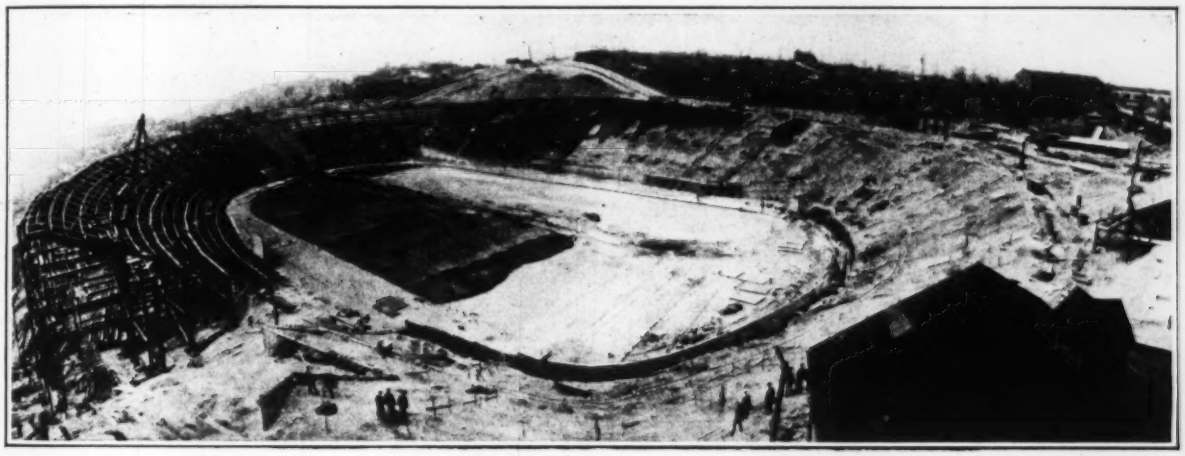


FIG. 2—STADIUM, HALF CONCRETE AND HALF STEEL, UNDER CONSTRUCTION

Caissons for reinforced-concrete columns were 5 ft. in diameter and the columns themselves 3 ft. in diameter. As foundation columns were built up the rest of the 5-ft. diameter hole was filled with granulated slag. There was thus provided a 12-in. shell of slag which protects the foundation columns from damage through the burning coal. With this plan of construction the stadium will be structurally safe no matter how much subsidence there may be of the shale underneath the reinforced-concrete section.

Construction—The seat deck is essentially a 12-in. slab on a 3-in. cinder fill for the part on the ground and a 4½-in. slab on the steel-supported part. The cinders are placed as insurance against frost action. Entrance to the stands in the reinforced-concrete section or that part which is wholly in the cut is to be had over the top from the rim inward. In the steel supported section entrance is had through a series of ramps. The contour of the ground was the controlling feature in the position of the ramps and the entrances to both parts of the seating area.

Concrete is handled from the mixing plant in 1-yd. industrial side-dump cars. Two-car trains are hauled by 6-ton gasoline locomotives around the rim of the bowl. From the rim all concrete is chuted into the deck.

Concrete is designed according to the Abrams theory. There will be approximately 20,000 cu.yd. of concrete in the structure. Two-thousand-pound concrete is being used in the walls and 2,500-lb. concrete in the deck. These mixtures correspond approximately to 1:2½:3½ and 1:1.8:3.2 mixes, respectively. Concrete mixtures are varied daily in accordance with analyses of sand and aggregate.

The inundation method of measuring sand has been adopted on the job. This was described in *Engineering News-Record*, May 7, p. 775. So far that method, according to the engineer in charge of the work, has given a very uniform concrete, although as yet no proof of uniformity has been possible. Pouring of the concrete deck began early in April and the inundation method was not adopted until that time. Therefore not enough cylinders have been tested from which to draw any conclusions as to the efficiency of the inundation method in securing uniform-strength concrete.

Steel supporting the deck was handled by a traveling crane with a span of approximately 25 ft. It was essentially a stiff-leg derrick with a steel lattice boom and mast. Its position may be seen in the accompanying photograph.

Drainage—A very effective drainage system is being installed for the drainage of both playing field and seat banks. With the field brought to an elevation 18 in. below the finished grade 4-in. open joint tile was laid in trenches on 15-ft. centers parallel to the minor axis. These were connected to an interceptor ranging from 10 to 15 in. in diameter and running around the outer area of the oval. The interceptors are so sloped that each quarter forms an independently-drained unit. Interceptors also collect drainage water from the seat banks. The complete drainage details are indicated in Fig. 3.

After the tile was laid 5 in. of coarse gravel was spread over the entire playing field. Upon this was placed a 4-in. layer of fine gravel and then 10 in. of top soil. A final topping of 2 in. of granulated slag was spread and then disked into the top soil so that the compacted depth is about 10 in. This gives a total depth of 18 in. of material above the tops of the drains which are buried in 6-in. trenches. The field is crowned 18 inches in the form of a turtleback and slopes to the track.

Turf Seeding—Before seeding the playing field all

stones over ¾ in. in diameter, sticks or other refuse will be removed from the surface and the surface brought to true grade with an allowance of 15 per cent for shrinkage. It will be thoroughly worked with harrows and rakes until all coarse lumps are broken up or removed. Fertilizer of the following composition will then be applied to the surface and carefully worked in before seeding: 6 lb. ground basic open-hearth slag, 1 lb. blast-furnace flue dust and 1 lb. of bone meal. This quantity of fertilizer is to be applied to each 100 sq.ft. of the surface. After the ground is seeded, it is to be sprinkled with a solution of 2½ oz. of ammonium sulphate dissolved in 10 qt. of water per 100 sq.ft.

The field is to be seeded with the following combination, the mixture being determined by weight: 17 parts of Kentucky blue-grass, 4 parts of redtop, 3 parts of perennial rye-grass, 1 part of white clover, and 1 part of timothy. Six pounds of this mixture will be applied to each 1,000 sq.ft. of area.

As an indication of the care with which the running track will be prepared four single lanes along one straightaway will be laid with varying mixtures of cinder, earth and sand. The University of Pittsburgh track team will be asked to use each of these lanes and whichever one is found the best for all purposes will be put over the entire running track. The running track has a 220-yard straightaway but both start and finish lines are in tunnels. The provision of this straightaway however, was made necessary for the University of Pittsburgh to be able to invite A.A.U. championship track meets.

Personnel—One of the features in the preparation of the design of the structure is found in the fact that Marion K. Hindman, daughter of W. S. Hindman, chief engineer of the Pitt Stadium Committee, who designed the structure, is furnishing the architectural details. She is a graduate in architectural engineering of Ohio State University.

Stone & Webster are the supervising engineers and the Turner Construction Co. is the general contractor. John F. Casey did the grading and the New England Foundation Co. the caisson work. McClintic-Marshall Co. furnished the structural steel.

Mr. Hindman, who was co-designer and supervised the construction of the Ohio State stadium, has embodied a number of design details in the Pitt Stadium which will be discussed in a subsequent article.

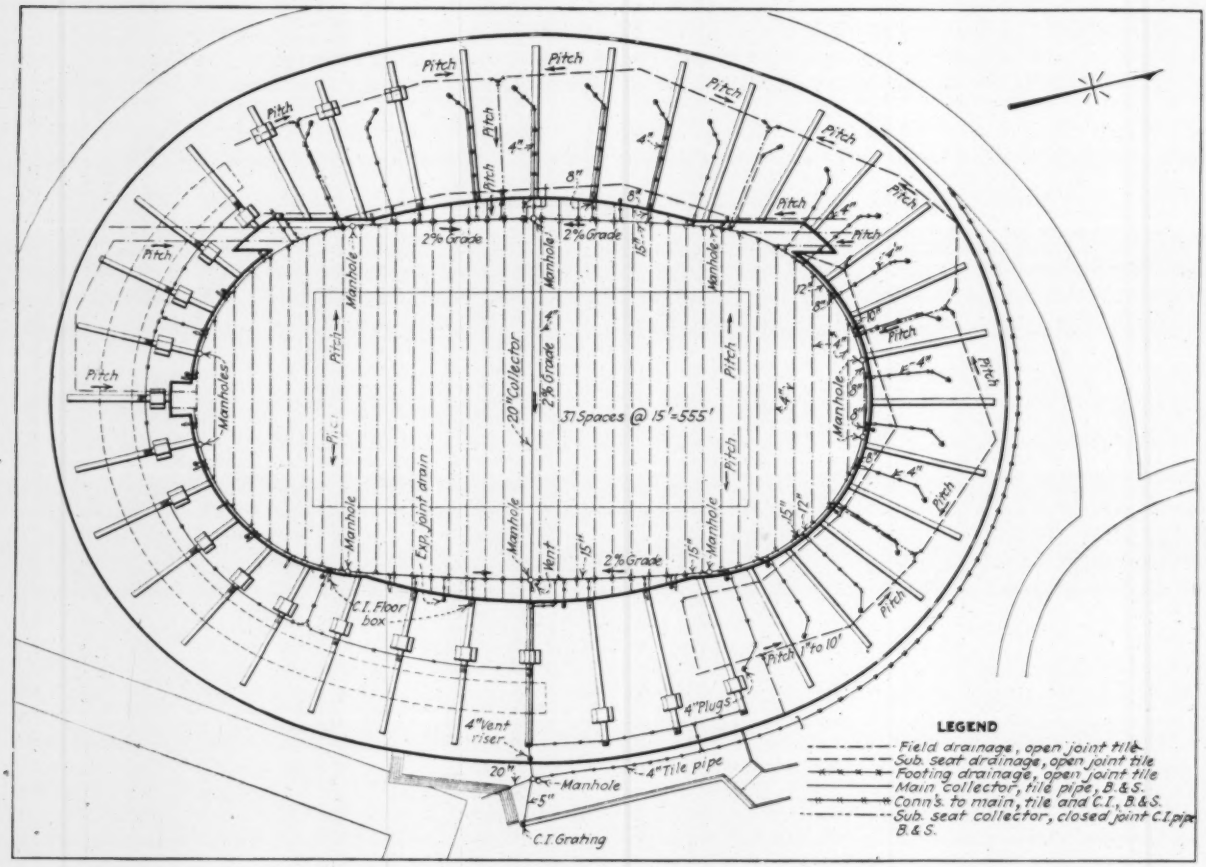


FIG. 3—PLAN OF DRAINAGE FOR FIELD AND SEAT BANKS

Hydraulic Power Resources of Switzerland

The water power resources of Switzerland are estimated at 3,000,000 hp. in times of normal flow of water and at 2,500,000 hp. at times of low flow. In 1921 Switzerland had 650,000 hp. or approximately 21 per cent of the available resources developed. This amount has been increased to approximately 1,000,000 hp. at the present time.

Engineering in the Small City

A series of notes from the field on the Problems and Practices of the Municipal Engineer in the Cities Below 100,000

The Editor Visits the City Engineer

Snapshots of Our Representative Small Cities

VIRGINIA ST. BRIDGE, RENO, NEV.

Reno, Nev.

THE LARGEST CITY IN NEVADA, located in desert foothill country on the main line of the Southern Pacific R. R. about 12 miles east of the Nevada-California state line. Because of its isolation the city has not attracted industries. However, its importance arises from this very isolation—small communities through western Nevada look to Reno as a center and do their trading there. Extensive mining properties of importance to the city include the Comstock Merger Mines at Virginia City, as well as properties at Tonopah, Goldfield and Yerrington. Reno would be only a dot in the desert were it not for the Truckee River which passes directly through the city, giving it a most attractive appearance and constituting its very life blood. The Truckee heads in Lake Tahoe and most of its water is used for irrigation, notably on the Newlands project some 30 miles below Reno. Population in 1924, 15,000.

FIRST impressions of Reno with its attractive buildings and homes and its extensive system of wide, well paved streets (Reno has 30 miles of paved streets in an area of 3 square miles) are apt to convey the idea that the city has a population of 25,000 to 30,000 instead of only about half that number. Even so, Reno is the largest city in the state and in fact the only one of importance in point of size. It far overshadows the capital, Carson City, 32 miles south, which has a population of about 3,000.

Reno is and always will be a sort of oasis. Crowding up close to its green lawns on all sides of the city is the foothill desert of the east slope of the Sierra Nevada Mountains. To the west the nearest city of importance is Sacramento, central California, 7 hours distant by automobile over the mountains on roads that are blocked by snow for perhaps six months in the year. For several hundred miles to the north, east and southeast, Nevada consists chiefly of uninhabited plains and barren mountains. Save for small irrigated areas or smaller communities here and there the land is undeveloped, forbidding desert. The 1920 census gives the state a total population of 77,407 or an average of 0.7 persons per square mile. Thus Reno is a city that has to be sufficient unto itself, as it were. There is comparatively little interchange of ideas and experiences in ordinary municipal affairs and the municipal organization has developed the habit of working out its own problems.

City Government and City Engineering—Reno's city engineer, Harry Chism, has full charge of all engineering activities and reports directly to the city council or to one of its committees. The council consists of one councilman from each of six wards and is presided over by its seventh member, the mayor. There is no board of public works but instead responsibility for various public works is vested in committees made up of members of the council, often a committee of one. Thus there are committees on parks, sewers, streets, public safety, etc., and to each of these the city engineer reports on the work involved. His staff consists of five field or office assistants and by contracting practically all construction work the organization is ordinarily kept down to this size although that means that on occasion the city engineer himself must issue permits or serve as building inspector.

Street Work—The system of financing and contracting paving work has some peculiar features, particularly in the construction of concrete curbs and gutters which are put in independently of the roadway proper. When a curb and gutter improvement project is decided upon, a cost estimate is prepared and an assessment is levied accompanied by a statement of charge per front foot to be made against each property holder. With this appears a statement of just what the improvement in front of each lot is to be. Between this time and the award by the council of a lump sum contract for the entire job, any property owner who so desires may enter privately into a contract for the construction of the work which the city proposes to do. Moreover there is no ordinance whereby the city has a right to inspect or reject the work done by individuals so long as it conforms in a general way to specifications and meets requirements of line and grade.

This has the disadvantage that the assessment against any individual property is an average for the entire improvement project and the actual cost in favorable locations may be considerably below the average. As a result these easy sections are snapped up at the city's average cost by small contractors while the "lean" or more difficult portions are left for the city contract.

In residential districts concrete curbs with 2-ft. gutters are standard. In thickly settled and business districts 8-ft. concrete gutters are used. In the roadways, proper asphaltic concrete is almost always laid and unlike the curb-and-gutter work this is always contracted by the city.

Assessments for the curbs and gutters are made separately from the roadway assessment because of a city ordinance which prohibits any single assessment exceeding 50 per cent of the assessed value of the property involved. By separating the work into two parts, more work can sometimes be done than would otherwise be legal. A total of assessments may not exceed 100 per cent of property value and where necessary work would impose such a burden on any property the city assumes the excess and charges this to the general fund.

Pavement that is contracted for at 20½c. per sq.ft. is charged to property owners at the rate of 25c., the 4½c. margin being used for intersections, office overhead, etc. This margin is not quite sufficient for this purpose and has to be supplemented from the general fund. Last year out of $220,000 worth of paving the city paid $20,000 from the general fund; this included the city's share of assessments that exceeded the legal maximum.

Insofar as property owners do not advance the cash for street improvement this work is financed by city bond issues. When an improvement project is decided upon and individual assessments are published, property holders have a minimum of 50 days in which to pay the total amount in cash after which the assessment becomes a lien against the property and can be paid off only in ten annual payments plus interest. It is notable that most Reno citizens usually pay off these assessments in advance. In the last improvement amounting to some $135,000 bonds were issued for only 20 per cent of the total. Such bonds as are issued bear interest at 7 per cent and usually sell at a premium of 3 to 4 per cent. The full amount of the issue is sold at once and credited to the city treasurer who draws upon it for monthly payments to the contractor. Under this plan the city loses interest on the money lying idle in the bank pending payment to contractor. The 10-year bonds are not particularly attractive to individual investors despite the excellent security and high rate of interest because one-tenth the total is paid off each year. However, the banks are ready purchasers for securities of this type.

The pavements in Reno contribute greatly to the attractiveness of the city. Trees have been planted extensively and many residence district streets are 56 ft. wide; everywhere the pavement is in excellent repair. Repairing is done under contract with money from the street fund and is light, totaling (excluding, of course, utility cuts) only $300 or $400 per year.

Utilities—Water, street lights and garbage disposal are all contracted to private companies, no responsibility attaching to the city engineer's office. It is to be noted, however, that Reno uses 650 gal. of water per capita per day, on the basis of a measurement taken at the inlet to the city's distribution reservoir and hence including evaporation and seepage losses. No meters are used. The water company, a subsidiary of the Stone & Webster Engineering Corp., has flat rates based on the kind of service and the area served. The ordinary residence rate is $2.75 per month. Doubtless an unusually large quantity of water is used for lawn sprinkling; however, this does not affect sewage flow and a recent measurement of Reno sewage in dry weather (a combined system is used) showed an average flow of 9 sec.-ft.

Some years ago a Cameron septic tank was built which cares for one-tenth the city's sewage. The remainder is discharged raw into the Truckee River below the city. Repeated agitation against this practice has been carried to the state legislature but despite the existence of a law prohibiting the pollution of streams no active measures have been taken to prevent this means of disposal. The minimum flow of the Truckee River seldom drops below 400 to 500 sec.-ft. and the cities that draw on the stream for their water supply are 30 to 40 miles downstream.

Irrigation Ditches and River Bridges—A peculiar problem in Reno is the necessity for making provision for four irrigation ditches that lie within the city and antedate its incorporation. The city has had to do more and more of this ditch work as expansion has continued. The ditch owners simply stand on their rights and demand that the city bear the total cost of new structures. The result has been that for much of their length through the city the ditches are now nicely housed in concrete culverts built at city expense and practically relieving the owners of maintenance that would have been required on the old ditches.

Reno faces a bridge problem that has not yet been worked out. There are already six bridges across the river within the city limits and others must be constructed. The council was last year about to declare a bond issue for the construction of the most necessary bridge when it became evident that citizens would not be satisfied unless two other bridges were also constructed. The council had then declared in favor of all three when a demand for an election was presented. As the city council has authority to issue bonds only if there is no call for election, the whole matter was postponed because obviously an election would have failed to aprove the bonds.

A concrete arch bridge on Center St. where a crossing is needed most would cost $50,000 to $60,000 and the right-of-way would cost as much again because of the necessity for removing existing structures. As a basis for working out the financial plan the city has declared in favor of 50 per cent of the bridge cost levied on an assessment zone (to be worked out by the city engineer) and 50 per cent to be appropriated from the city's general fund.

A fact of rapidly increasing importance to Reno is that through the city are routed both the Lincoln and the Victory highways. This summer it is estimated that an average of 75 to 100 automobiles from other states pass daily through the city. When it is remembered that touring of this sort involves traversing chiefly desert country for many hundred miles east of Reno it becomes apparent that this traffic will increase materially as improvements now being made on these routes are completed. The city does not maintain an auto camp.

Engineering Work

Water Front Zoning at San Diego

By M. A. Graham
President, Board of Harbor Commissioners, San Diego, Calif.

From a paper read before the Pacific Coast Association of Port Authorities.

WE HAVE just completed a zoning plan for the harbor of San Diego after several years' study during which we employed such engineers as the late B. F. Cresson and Charles W. Staniford, and then John Nolen, one of the foremost city planners, to co-ordinate our plan with the city plan with particular reference to streets, street railways and all modes of transportation. Five zones have been established.

Zone A has been set aside as a strictly recreational zone and will have within its limits such activities as yacht basins, yachting clubs, rowing clubs, swimming beaches and also the Navy Training Station and the U. S. Marine Corp Base. The latter two occupy approximately a mile and a half of water front.

Zone B fronts on the main section of the city and is set aside for passenger, express and pleasure boats. It embraces 150 to 200 acres of tidelands.

Zone C adjoins zone B and has an area of about 50 acres which is set aside for warehouses and light factory buildings.

Zone D is what is known as the "hub" development and is on a turning point in the harbor and is intended to provide space for ferry landings and small recreational parks. It has an area of some 10 or 12 acres and is the dividing line between the lighter zones and the strictly commercial zone.

Of the Small City

Zone E is some three miles in extent and has an area of several hundred acres of tidelands and is set aside for industrial purposes and for the construction of commercial piers for which there is space for some 12 or 14 piers 400 ft. wide by 1,500 ft. long. This section will provide for the heavy industries and is so located that the prevailing winds will carry all smoke and odors, that may arise in this section clear of the city.

Small Sewage Pumping Station at Eveleth, Minn.

By H. A. Robinson

Civil and Mining Engineer, Eveleth, Minn.

A SMALL sewage pumping station with duplicate motors and pumps, storage reservoirs in duplicate, and each reservoir provided with an inlet screen of unusual design and with a second screen on the outlet to the pump, was built at Eveleth, Minn., in the fall of 1924. The pumping station diverts to the main sewage-works of Eveleth the sewage from two sections, one within and one outside the city, that formerly discharged into Fayal Pond, after passage through septic tanks, one located on each of two small outlet sewers. One of these outlet sewers served the "Fayal Mine Location," in Fayal Township, adjacent to Eveleth.

Fayal Pond, which received the septic tank effluents, discharges through a creek into and through three lakes—Mud, Horseshoe and Long. Farmers and cottagers on the shores of Horseshoe and Long lakes had been complaining of pollution from the septic tanks. Although examination of the waters of these two lakes showed no evidence of sewage pollution it was decided, to prevent threatened litigation, to divert the sewage from Fayal Pond, as already stated.

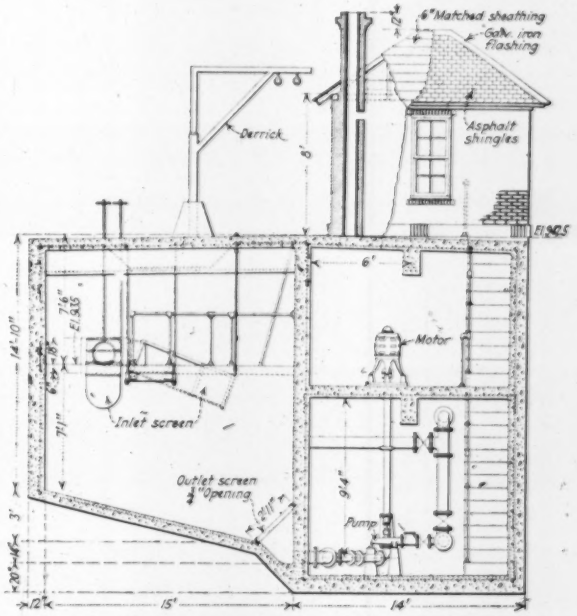
Tributary to the two sewer outlets and septic tanks were 149 residences and a high school, the latter with a metered water consumption averaging 30,000 gal. a day. Assuming 200 houses with six persons each as the ultimate development of this territory and a maximum per capita water consumption of 200 gal. from the houses, and no increase in the supply to the high school, would give a maximum total water consumption of 0.27 m.g.d. or 187 g.p.m.

The static head on the pumps is 86 ft., so with an assumed friction head of 4 ft. in 2,400 ft. of 8-in. cast-iron force main, the total head is 90 ft. With 45 per cent pump efficiency this would require 9.5 hp., or with 90 per cent motor efficiency, a 10.5-hp. motor.

A study of the meager available literature on small sewage pumping stations, and inspection of some stations in this vicinity, led to the inclusion of certain features in this pump station with the idea of eliminating faults in the operation of the stations inspected.

In all the stations examined there was only one chamber for storage between pumping periods. It is necessary in all the stations to clean out this chamber at various intervals and with only one chamber it is necessary to bypass the raw sewage or to stop up the sewers. With the idea of eliminating this we have used two storage chambers, a main chamber with a holding capacity of 12,400 gal. and an auxiliary chamber of half that capacity. Either or both pumps can pump from either chamber.

The screens used in the stations examined were of the basket type. This type very soon clogs up from paper and other refuse and then, unless cleaned frequently, the sewage overflows without any screening. To reduce screen cleaning to a minimum we used a semicircular screen (one in each chamber) open at the top except at the lower end, where it is enclosed to prevent the escape of the clogging material. The screen is suspended in an inclined position so that the sewage flows down over the screen and clogging material, moving the clogging material along the screen and breaking it up. These screens are working satisfactorily. In addition to the spout-shaped screens the outlets of the storage chambers are protected with inclined screens. A small hand-operated derrick provides the means for removing the screens of each set for cleaning or repairing. All the screens are of brass wire with ¾-in. mesh opening.



SECTION THROUGH SEWAGE PUMPING STATION AND STORAGE CHAMBERS, EVELETH, MINN.

Everything in duplicate, except that one of storage chambers has only half the capacity of the other.

The storage chambers, motors and pumps are underground. A small brick shelter house serves as an entrance. This is necessary in a climate where several feet of snow lie on the ground for some months in the year.

The pumping machinery is in duplicate. It consists of two 200-g.p.m. vertical, motor-driven centrifugal pumps, designed to operate under a total dynamic head of 115 ft., with a maximum speed of 1,800 r.p.m. The impellers are of government bronze. Extra large clearance was provided to avoid clogging. The pumps were made by the Kingsford Foundry & Machine Works, Oswego, New York. The motors are 15-hp. vertical, 3-phase, 60-cycle, 220-volt, squirrel-cage, induction type, arranged for conduit connections. Control is "across the line" type, 3-pole with thermal overload protection for operation by float switches. G. E. float switches are installed in the receiving chambers.

The station is well lighted throughout, vapor-proof fixtures being installed in the sewage-receiving chambers.

Additional Notes on Santa Barbara Earthquake Effects

Engineers Present Conclusions on Types of Construction and Suitability of Different Materials for Earthquake-Resisting Construction—Agree in Charging Most Serious Failures to Poor Work

NOTES on the effect of the Santa Barbara earthquake of June 29, supplementary to the observations reported in our issues of June 9 (p. 69) and July 23 (pp. 146 and 149) are given in the following, from reports or memoranda prepared by several different engineers. Col. Clarke S. Smith, of Los Angeles, made a careful survey of the effect upon buildings in Santa Barbara, on July 2 and 3, when the aftershocks of the earthquake were still felt frequently. Albert C. Martin made a similar survey as member of a committee of Los Angeles engineers which went to Santa Barbara at the request of the mayor for emergency survey of buildings. M. B. Reilly and Joseph K. Moore surveyed the building conditions for the Hollow Building Tile Association. Their several conclusions, though based on different observations and viewpoints, are in good agreement.

Building Types and Weaknesses

Colonel Smith's conclusions are as follows:

Reinforced Concrete—Well-built reinforced-concrete structures of good design, material and workmanship withstood the earthquake well. This was particularly the case where the building was not over two stories high. The racking effect is severe in taller structures; nevertheless well constructed buildings as tall as eight stories appear able to withstand an earthquake equal in severity to that of June 29 without serious damage. However, due to inferiority of design, material and workmanship or any of them, a reinforced-concrete structure may not have the requisite strength against an earthquake shock.

Brick and Tile—Ordinary brick work has little strength in resisting earthquakes. Where the quality of the material and workmanship was exceptionally good, brick buildings two stories high withstood the Santa Barbara earthquake, but this appeared to be exceptional. Brick buildings without metal or reinforced framework higher than two stories seem to have but little chance of surviving such a catastrophe. Where the height of the structure is above two stories, mere massive construction like the Mission towers is not sufficient to withstand the shock.

Whether brick veneers will hold seems to depend on the quality of the material and workmanship, and probably on the direction of the greatest swaying material and workmanship. Brick veneer remained intact on a well constructed façade of eight stories, but crumbled off a lower one. The advisability of using tiles and veneers on high structures is questionable in territory where earthquakes occur.

Tiles for roofs of moderate slope stood well in two-story structures, but were badly shaken down on the cornices of the three- and four-story Arlington Hotel.

Frame buildings one and two stories high on good foundations stood the shocks well. In this class is included the frame building with outside stucco plaster over wire netting, a kind of construction deservedly popular in Southern California.

Weak Features—Walls insufficiently anchored, heavy projecting cornices, massive overhanging terra cotta, oramental columns not well secured at top and bottom, weakly tied entablatures and pediments, insufficiently bonded coping stones and lintels, weighty suspended door canopies, and poorly fastened ornamental work of all kinds, should be avoided.

Colonel Smith calls special attention to the fact that the time of the earthquake (6:42 a.m.) was responsible for the small loss of life, as the business buildings and streets were practically empty. He adds that if the warning for better construction, especially in the business section, is not heeded, "the future loss may be great and the responsibility heavy."

Steel-Frame Construction Commended

The comment of A. C. Martin gives special commendation to steel-frame construction. The following conclusions are quoted:

The Santa Barbara damage was 98 per cent due to poor design of structure and foundations, poor workmanship, or poor materials. Class C buildnigs, with brick in cement mortar and walls well anchored, particularly where continuous concrete tie beams were used, stood excellently. Steel roof trusses with skeleton wall construction form the safest kind of investment. Reinforced concrete, where designed by engineers with experience, is excellent for buildings of height not to exceed one and a half times the narrowest dimensions. The columns should not be too small in cross-section. Concrete floor construction is perfectly suited to the required service. Steel-frame construction fireproofed with concrete should be ideal.

Hollow-tile exterior walls should not be encouraged. Good brick in mortar tempered with cement is an excellent material.

Experienced architects, structural engineers and contractors constitute the best means of assuring earthquake-resisting construction.

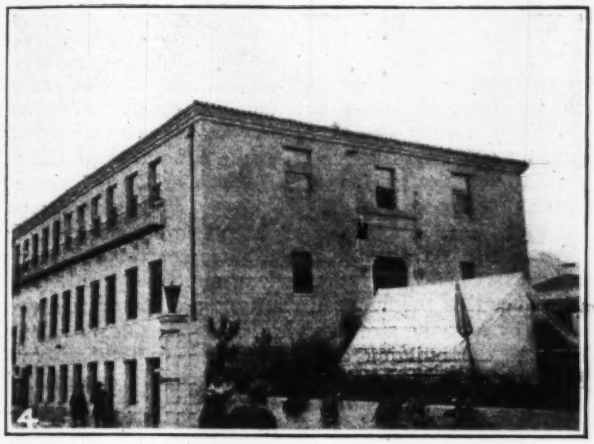
Mr. Martin observes, however, with respect to brickwork and hollow tile, that they withstood well where well built: "No damage was done to good brickwork, concrete work, hollow-tile partitions, or in fact to any good construction." He ascribes the failure of the brick walls of the Californian Hotel to poor mortar, insufficient anchorage between joists and walls, and the unfavorable location of the building, which was built in a swamp (the owners had been advised to build on piles, but did not follow this recommendation—Reilly and Moore).

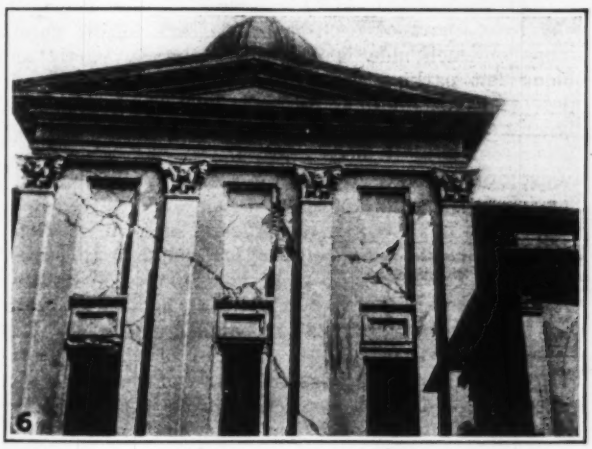
Reilly and Moore Report

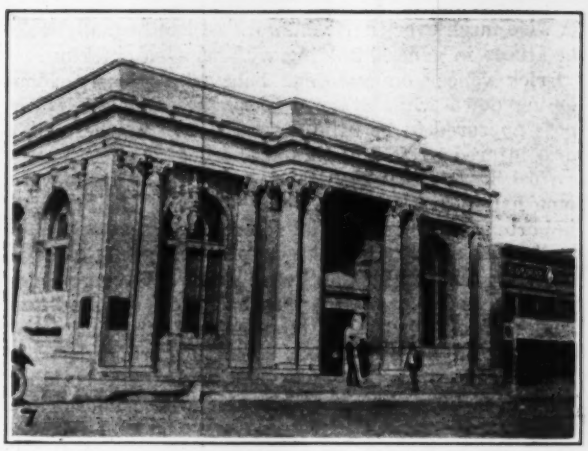
Dealing more particularly with the showing made by hollow tile at Santa Barbara, Messrs. Reilly and Moore first review the observed effects on different types of construction and different materials, with the conclusion that, whether in concrete, brick, stone or tile, the observed failures were largely or wholly attributable to faults in design or construction. They then say:

With the exception of the Christian Science Sunday School, all the tile bearing walls which came under our notice were built of partition tile and not load-bearing tile, and in all cases the mortar was lime mortar, in no case cement mortar. The Sunday School was built of interlocking load-bearing tile, walls 150 ft. long and 20 ft. high; this building did not have a single crack and is in as good condition as when built. Many examples of hollow-tile residences are to be seen all over the city standing intact. Many of these buildings have lost their chimneys, which were built of 4-in. brick without the use of flue lining. The Buick garage, built of partition tile with partition brick pilasters, also came through intact, as did the Nash garage.

In one case of freak construction of tile, partition tile was used in a bearing wall, laid end construction, in what is known as "Ideal brick wall" construction. The front of the building collapsed, showing no bond between the front and the side walls. The mortar was soft lime mortar. The side walls remained intact without crack.







ADDITIONAL VIEWS OF SANTA BARBARA BUILDINGS

Figs. 1 and 2—Northwest and southwest wings of San Marcos Building.
Fig. 3—Frame structure with face wall thrown down.
Fig. 4—Municipal Building, practically undamaged.
Fig. 5—Carillo Building, little damaged.
Fig. 6—Pilaster displacement in Court House.
Fig. 7—Pacific Southwest Trust & Savings Bank.

If good workmanship, good mortar and proper design had been used in the tile work throughout the city, the material would have had a clean record and at all events would have offered a minimum of cost in replacement.

The St. Francis Hospital is cited as the outstanding example of failure of the concrete frame and tile wall type of building. Faulty design and poor construction are involved. The curtain walls were made of partition tile, set end construction, in poor lime mortar, and had ordinary lath in the joints every third course of tile; the position of the lath is revealed by cracks in the plaster, or else the tiles are sprung from place here. However, interior stairway walls, of concrete, did not stand any better than the tile.

In the accompanying group of views, reproduced from photographs of Colonel Smith, are shown some effects supplementary to the information given in the articles in our issues of July 9 and 23, already noted. The first two views show two different wings of the San Marcos building, the northwest wing apparently without a vestige of bond to the failed corner portion, the southwest wing bonded, although the rods pulled out of the concrete. Mr. Martin mentions pipe sleeves in columns, above the floor line, as a particular element of weakness.

Colonel Smith remarks that from observation on a large number of buildings it appears that the greatest disturbance was in a direction perpendicular to State St., as many cases are found where the State St. wall of a building is intact or little cracked, while the walls at right angles are seriously cracked.

A reinforced-concrete structure that resisted perfectly is the new City Hall, Fig. 4, a new structure with columns, beams, floors and walls of reinforced concrete, the roof of tile. It suffered no apparent damage. The six-story Central building, with reinforced-concrete frame and hollow-tile walls, had the face at right angles to State St. cracked in many places. The Carillo building (not the hotel of the same name), Fig. 5, a two-story reinforced-concrete structure, suffered slight damage from cracking, but the arches of the street arcade were not injured and the building as a whole resisted excellently. It forms a striking contrast to the structure shown in Fig. 3.

Peculiar cracking is shown in Fig. 6, illustrating the rear of the court house, an old two-story brick structure carrying a dome. The brick pilasters are sheared in opposite directions.

In wood frame residences, hotels and the like, one or two stories high, little damage was noted except that brick chimneys were thrown down and some fireplace brickwork was destroyed. Buildings with stucco face on wire mesh over the framework resisted equally well, the stucco in general holding without even cracking.

Brick veneer on buildings behaved variously, some coming down while other veneers held in place. Tile roofs appeared to be little disturbed except where they were injured by falling chimneys or cornices.

Steel Structures—Mr. Martin reports that there were some half dozen one-story buildings with steel trusses supported on either steel or reinforced-concrete framework. In all of these cases practically no damage resulted. The Pacific Southwest Trust & Savings Bank (Fig. 7) is an example; this had steel columns and trusses, brick filler walls, terra cotta facing and trim, and suffered no more than some plastering damage. It contrasts with the First National Bank building (Fig. 5, p. 70, July 9). A theater whose auditorium was strengthened with steel pilasters and roof trusses, with walls anchored to the steelwork, remained intact, while the stage walls failed, being devoid of bracing by steelwork. The Post Office, of steel frame with brick curtain walls and concrete floors, remained intact except for some cracks around stairways. (Reilly and Moore).

Hollow Tile—Where hollow tile was used for curtain walls of concrete skeleton buildings, Mr. Martin states that in practically all cases these walls, 12 in. thick, consisted of 4 in. of tile on inside and outside with an air space between and an occasional bonding tile. In the swaying of the buildings the outer walls of the outer tile failed in compression and fell to the ground.

Garage With Warped Floor Areas Connecting Ramps

Grades Between Floors Reduced Without Loss of Parking Space—Special Beam Plan—Car Movements Facilitated

IN A new design of multiple-story garage having ramps of short lengths and easy grades to connect the floors, a special feature is that a part of each floor adjacent to the ramp is on a slant or slight grade in order to reduce both the grade and length of the ramp and thus facilitate the movement of cars, especially in the descending direction, which usually is the most difficult or hazardous. Reduction in the number of interior columns is another feature. It is claimed that in this way there is easy and convenient movement of cars on each floor and from floor to floor, while a maximum parking or rentable space is provided.

For commercial garages of the multi-floor type, it is important to secure the maximum storage or parking space and yet provide adequately for moving cars quickly between street and parking space. Elevator service is usually slow, time being consumed in moving cars on and off the elevator, while a number of elevators would occupy too large a proportion of rental space. The more general practice is to provide ramps by which cars can be moved from floor to floor under their own power; a continuous ramp for the full story height is usually on rather a long and steep grade, and to reduce this the floors in one type of construction are offset by half the story height, so that the floors in one part of the building are half the story-height above those on the other part, thus shortening the ramps. A later design provides the combined ramp and slanting floor as in the Keher garage at Louisville, Ky., a four-story structure 50 ft. wide, to store 160 automobiles.

In brief, part of each floor adjacent to the short ramps on each side is a warped surface, partly an oblong flat parking space, partly a slanting parking space and partly a ramp. Thus, according to the designer's description, the car first ascends a ramp of 10 per cent grade, giving a rise of 3 ft. It then makes a quarter-turn on a level parking space, and ascends a slanting-floor parking space of 7 per cent grade giving a rise of 2 ft.; another 10 per cent ramp, a quarter-turn and a slanting parking space complete the total rise of 10 ft. or height from floor to floor. As the ramps are straight and 20 ft. wide, the two lines of cars in opposite directions are handled easily.

Modified designs used in garages of this type at Detroit and Cleveland have the grade of slanting floor reduced to 3½ and 4 per cent with a corresponding steeper grade, of about 10 per cent, for the short connecting ramps. The actual arrangement in any specific case depends largely upon the shape and size of the building. It will be noted that some of the cars are parked on slanting portions of the floor, but it is pointed out that the slant is considerably less than when cars are parked parallel with the curb of a city and is not sufficient to cause any bad effect on the cars.

A minimum of interior columns is another feature permitting the parking of rows of cars side by side, with a driveway wide enough for easy movement in and out of the parking space. In the Keher garage there are only four interior columns, around a central space 22½x14 ft., as shown, carrying a line of girders from

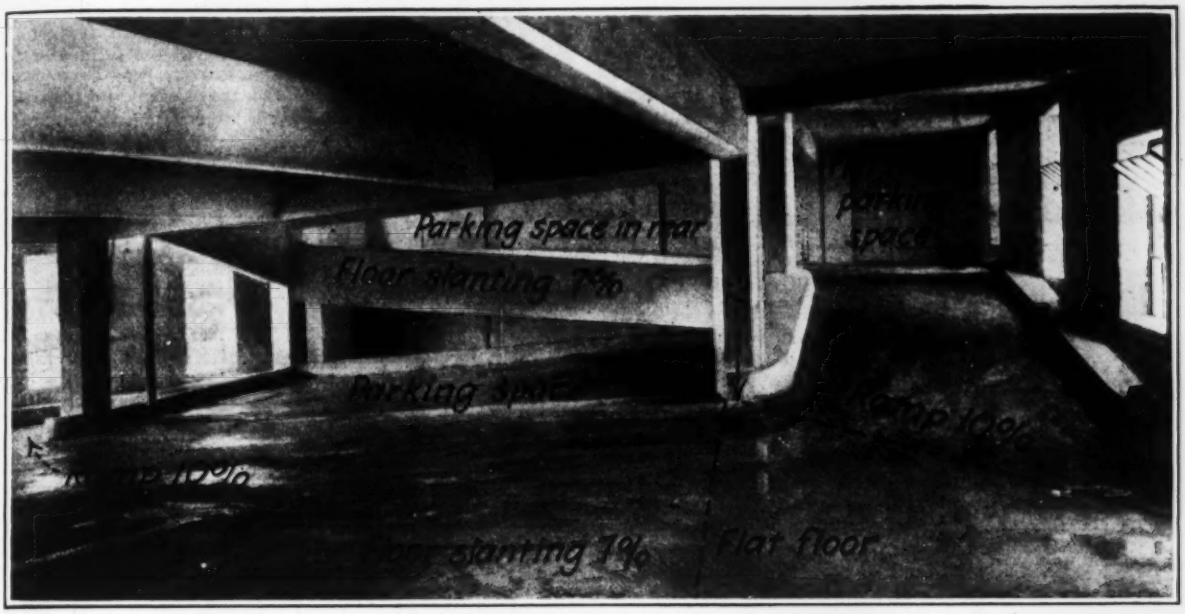


FIG. 1—GARAGE WITH RAMPS AND SLANTING FLOORS

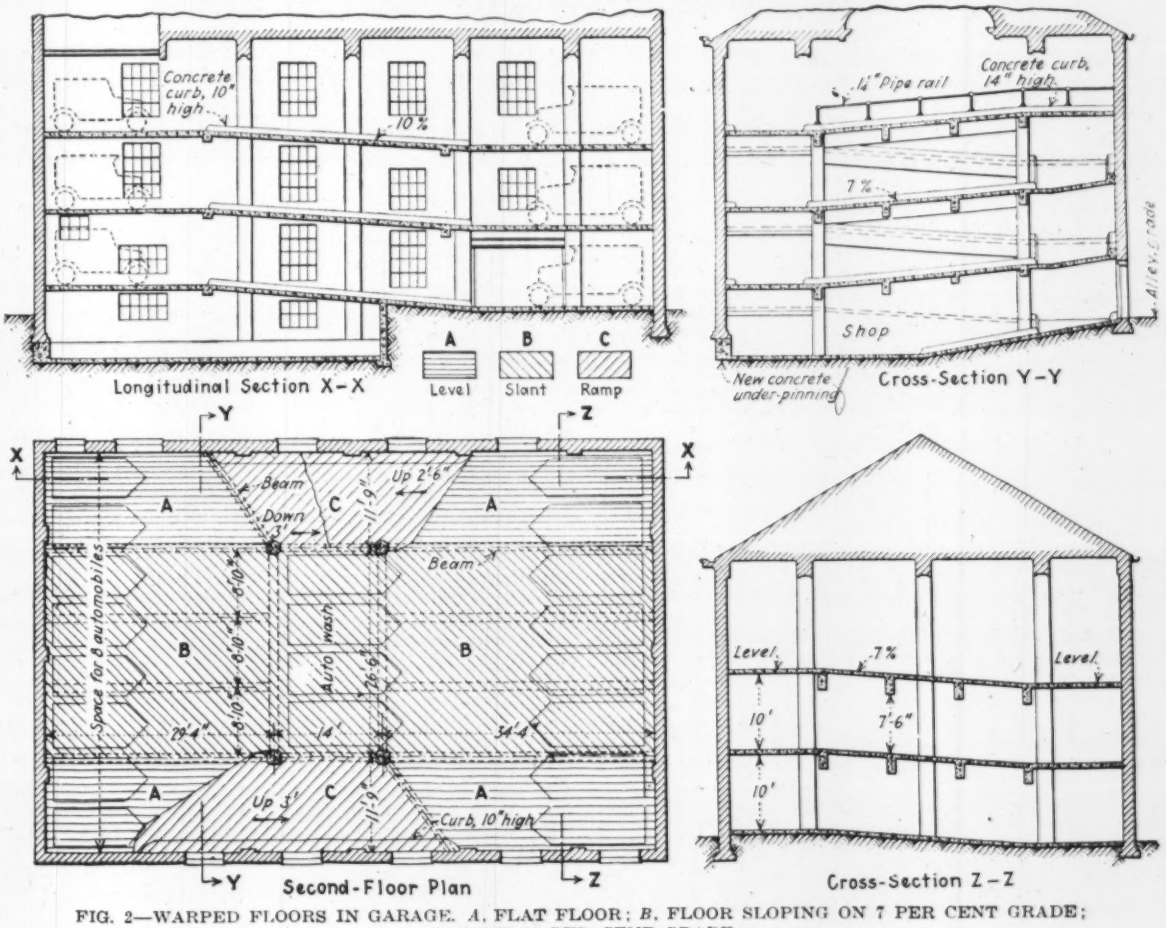


FIG. 2—WARPED FLOORS IN GARAGE. *A*, FLAT FLOOR; *B*, FLOOR SLOPING ON 7 PER CENT GRADE; *C*, RAMP 10 PER CENT GRADE

which beams extend to the wall columns. The slab thickness is 4½ in. for the flat floors, 4 in. for the slanting floors and 5 in. for the ramps, all designed for a live-load of 100-lb. per sq.ft. Steel trusses spanning the top floor support the roof and carry a suspended ceiling. A basement contains the repair shop, supply room and heating plant. Washing platforms are in the central bay of the first and second floors. The architect for the Keher garage was P. O. Reuter, Louisville, Ky.

This warped floor arrangement, which has been used in a number of garages, is covered by the patents of the Garage Experts Association, Louisville, Ky.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Another Concrete Placing Record

Sir—In reply to the question "Is this a Concrete Placing Record?" on p. 113 of *Engineering News-Record*, July 16, 1925, referring to record made by Bent Bros., Inc., of 47,000 cu.yd. of concrete placed in the Exchequer dam in 28 working days of two 8-hr. shifts, I would refer you to the record made by H. S. Kerbaugh, Inc., under the superintendence of George H. Angell in building the Kensico dam of the New York Board of Water Supply in Westchester County, N. Y., during the years 1913-1914.

In the Exchequer dam record the daily average was 904 cu.yd. per 8-hr. shift. At the Kensico dam in 1913 316,000 cu.yd. of masonry were placed in 200 working days of 8 hours each, or an average of 1,580 cu.yd. of masonry a day. In 1914 489,750 cu.yd. of masonry were placed in 221½ working days of 8 hours each, or an average of 2,211 cu.yd. of masonry a day. The best day's work was 3,572 cu.yd. This was cyclopean masonry with 27.1 per cent large stone. Deducting the volume of large stone from the above quantities gives the following quantities of concrete:

1913 Total concrete—230,364 cu.yd. in 200 working days of 8 hours each. Daily average, 1,151 cu.yd.

1914 Total concrete—357,028 cu.yd. in 221½ working days of 8 hours each. Daily average, 1,612 cu.yd. Best day's work, 2,604 cu.yd. of concrete.

Gravity mixers of 2-cu.yd. capacity were used for the larger part of the work. The largest day's work for any one mixer was 1,143 cu.yd. in eight hours.

WILSON FITCH SMITH,
Chief Engineer, Bear Mountain Hudson River Bridge Co.

New York, N. Y.
July 20, 1925.

Frozen Concrete Due to Undesirable Material?

Sir—Referring to the article in your issue of July 2, 1925, entitled "Multiple Arch Dam Disintegrates Under Low Temperatures," it is the writer's experience that dense concrete equal to 1:2:4 mix in richness made with clean aggregates, which have a water absorption of less than 1 lb. per cubic foot will not be disintegrated by freezing and thawing.

The article referred to mentions that screenings from a rock crusher were mixed with the sand. It does not state whether or not the dust was first taken out of these screenings. The kind of rock used for the coarse aggregate and the nature of the sand are not mentioned, except it is stated that the sand carried 3½ per cent clay and 1 per cent dirt.

It is the writer's experience that clay is very undesirable material in concrete and especially when the concrete is subjected to freezing and thawing. If the coarse aggregate used was limestone or in the nature of shale and the crusher dust was mixed with the concrete, that in itself is sufficient to cause disintegration by frost. The description of the appearance of the disintegrated concrete and the way it could be picked out, tallies with the characteristics of concrete made with aggregates containing clay or crusher dust which have come to the writer's notice.

The writer has observed repeatedly that such concrete will begin to go to pieces in one season, whereas concrete made with clean aggregates which have a small per cent water absorption will show little or no effect of frost after years of service.

The writer understands that the dam described in the said article is the one to which J. L. Savage referred in his reply to my letter relative to the Black Canyon Dam published in your issue of Jan. 22, 1925, and which he used as an argument against dams of this type.

In the opinion of the writer, the disintegration of the Gem Lake dam is no more of a valid argument against the use of reinforced concrete in dams than the failure of the Austin dam and numerous other gravity type dams is an argument against the use of the gravity type preferred by the U. S. Reclamation Service. Neither is a safe or durable structure unless designed and built with scientific precision on correct engineering principles. When these conditions are satisfied, the selection of the design becomes an economic question. If engineers hope to earn and hold the respect of the business world they must base their decisions upon sound economics and eliminate needless waste in the design and construction of engineering works.

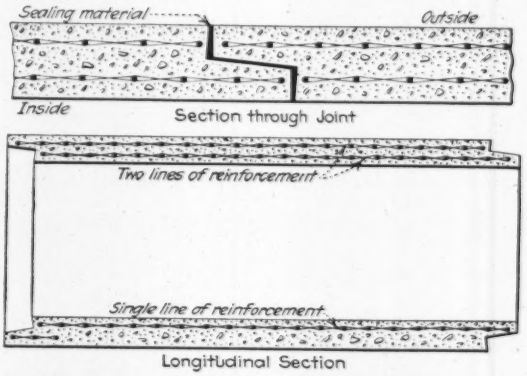
WALTER H. WHEELER,
Consulting Engineer.

Minneapolis, Minn.
July 7, 1925.

Flush-Joint Truly-Aligned Reinforced-Concrete Sewer Pipe

Sir—The article by A. G. Dalzell entitled "Points in the Design and Construction of Pipe Sewers," in *Engineering News-Record* of July 2, p. 20, has been read by me with much interest, especially as the company with which I am connected has spent much effort in trying to obviate some of the faults to which Mr. Dalzell calls attention.

For use in 12-in. sewers and up we have perfected a joint which assures true alignment at all times and tight joints. This joint (see sketch) consists simply of a spigot end which really fits a bell end which does not extend beyond the outside of the barrel of the pipe. The spigot end is cast inside of a machined cast-iron ring, which ring fits perfectly over another machined cast-iron ring, outside of which the bell is cast, so that of necessity the spigot fits snugly into the bell on the finished pipe. A small amount of mortar or asphalt cement placed in the bell before entering the spigot squeezes out, in part, as the sections of pipe are pushed together and makes a tight joint, at the same time giving true alignment as the joint becomes tight, because the width of the end of the spigot is exactly the same as the width of the shoulder at the base of the bell.



REINFORCED-CONCRETE PIPE WITH FLUSH JOINTS
Laying length, 4 ft. depth of bell and length of spigot each 3 in. for 18- to 30-in., 4½ in. for 33- to 60-in. pipe.

Both the bell and spigot mold castings are exactly centered by the steel form sheets in which the wall of the pipe is cast. These sheets are accurately squared before bending and must stand perpendicularly on the machined base ring and for the same reason the machined spigot ring must lie parallel to the base ring and properly centered, because of a groove into which the outside form fits in both base and spigot ring.

We also supply 4- to 24-in. sizes of machine-made concrete pipe with the old-fashioned deep and wide socket but would gladly change this to a type in which the spigot fits tightly into the bell were it not for the fact that most contractors and engineers appear to prefer the wide socket in that shape of pipe.

FRANCIS H. SHERRERD,
General Manager Newark Concrete Pipe Co.

Newark, N. J.,
July 6, 1925.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Court Approves Builders Pay Agreement

Indiana Court Finds Agreement Not to Exceed a Maximum Rate of Pay Legal

The Indiana Appellate Court, in a recent decision, upheld the maximum wage agreement of the members of the Building Trades Employers Association of the Calumet district, an agreement in which the members of the association bound themselves not to pay wages above a certain amount for the various classes of labor. In the case just decided, the members of the association had agreed that the rate of pay for a certain piece of work was to be $1 an hour. The defendant had given a bond of $1,000 that he would abide by the agreement, as had all other parties to it. It was found, however, that in order to secure sufficient labor, the defendant had paid $1.25 an hour in some cases. Suit was brought in the county courts against the defendant and his bondsman for violation of the agreement. The lower court upheld the agreement and the case was appealed.

The Appellate Court in sustaining the lower court in its finding that the appellant had violated the rules of the association and therefore was subject to fine, said:

"Appellants concede that the articles of incorporation, in evidence, disclose that it is an association organized for a lawful purpose; that the state of Indiana recognizes the right of workmen to combine and promote their own interest and to enforce their combination by any lawful means; that what one may lawfully do alone he may ordinarily do in conjunction or combination with others, and that any lawful purpose may be enforced by any lawful means which includes the right to make lawful rules and lawful bylaws for the members and to enforce them by fines, etc.

"In this state the law recognizes the right of laboring men to combine to promote their own interests and to enforce their combination by any lawful means, even to the extent of picketing an employer's premises.

"If the employee has the right to say what wages he will work for, the employer should have the right to say what wages he will pay. If men may lawfully combine to accept a minimum wage which they fix and may enforce that combination among themselves by fine, suspension or other form of discipline, employers may likewise form a combination for any lawful purpose, including the fixing of a maximum wage, and enforce it by the same means available to employees.

"If labor organizations and similar associations do not have the right to enforce compliance and submission to their rules, regulations and bylaws, then they would be powerless and the courts have upheld such organizations so long as they are organized for a lawful purpose, and will aid them in carrying out and enforcing all contracts with reference to the same.

"Appellants earnestly contend that this action can not be maintained as the whole theory of the case is wrong; that the contract on which it rests is void as being against public policy and in restraint of trade. We do not think so. The evidence shows, and the court trying the case found, that appellant violated his bond and there is no reason why either he or the insurance company should be exempt from the payment of the penalty of the bond."

Engineering Fifty Years Ago

From *Engineering News*, August, 1875

Water Meters

IN REGARD to the waste of water, the Board of Public Work of Chicago recommend the general use of meters, whenever the financial condition of the city will allow of their purchase. The comments of the board upon the waste of water are very forcible and pertinent, and ought to commend themselves to water-users throughout the city.

Contracts for D. & H. Canal Let 100 Years Ago

Contracts for the construction of the Delaware & Hudson canal from Rondout, on the Hudson River, to Honesdale, Pa., were let in July, 1825, and on July 13 Philip Hone, president of the Delaware & Hudson Canal Co., broke ground for the work. The canal, which was built for the purpose of bringing coal from the Pennsylvania mines to the Hudson River was completed in October, 1825, for boats of 30 tons capacity. In 1844 it was enlarged to pass boats of 50 tons capacity, and again in 1852 it was further enlarged for boats of 130 tons. The canal was abandoned about 25 years ago, but the company has been continued as a railroad company.

Southern Pacific Branch Line Extension Authorized

The Southern Pacific Co. has been authorized by the Interstate Commerce Commission to extend its Sutter Basin branch from a point near Hinsdale, Calif., northwest a distance of 10 miles in Reclamation District No. 70. Construction is to be started before Sept. 1 and completed before June 30, 1926.

Belt Line Railroad Around Washington

To Serve Industries Developing Just Outside District of Columbia—Project is Opposed

Construction of a 19-mile belt line railroad around part of the city of Washington, D. C., is proposed by the Washington & Loughborough Belt Line & Terminal Co. in its application to the Maryland Public Service Commission for permission to exercise its franchises, rights and privileges granted to it under its certificate of incorporation and the laws of Maryland. The route of the proposed railroad, as outlined in its petition, is as follows:

From a point upon the boundary line between the State of Virginia and the State of Maryland at or near Little Falls of the Potomac River, northwest of the northwest limits of the District of Columbia, passing in a northeasterly and southeasterly direction, approximately parallel, respectively, to the northwesterly and northeasterly boundary lines between the District of Columbia and the State of Maryland, in Montgomery and Prince Georges Counties, Maryland, to a connection with the Washington, Baltimore and Annapolis Electric Railroad Co. at a point 1 mile, from the most easterly corner boundary of the District of Columbia, a distance of 19 miles."

The company proposes to develop an industrial center southwest of Chevy Chase and just beyond the District of Columbia in Loughborough. This location was chosen, according to the petition, in order to render belt line and terminal services to an area which is rapidly becoming industrial in character, and more especially to afford railroad facilities to the industrial center now in course of development in Montgomery County, Md., southwest of Chevy Chase and just beyond the boundary of the District of Columbia and known as Loughborough. Certain restrictions and limitations placed upon the maintenance of factories, warehouses and other business enterprises within the limits of the District of Columbia have made it desirable for these industries to locate outside of the District of Columbia in Maryland. It is proposed to devote certain areas of Loughborough exclusively to industrial development, and for this purpose the area has been, or will be, acquired by the Loughborough Development Corporation for the purpose of rendering belt line and terminal service to the area by means of the proposed belt line railroad.

The proposed line is being opposed by property owners in the portion of Maryland adjoining the District of Columbia, who fear that such a railroad and industrial development will spoil the area for residential purposes.

WASHINGTON NOTES

Work on the Ohio River dams has progressed so rapidly, because of the favorable working season, that it has been necessary to allocate an additional $1,250,000 to carry the construction program forward until winter. The unexpected progress being made will bring materially nearer the date when the nine-foot project will have been completed.

The nine-foot development between Pittsburgh and Cincinnati is practically complete. The finishing touches are being put on the last dam in the upper river—No. 32 between Portsmouth, O., and Maysville, Ky. This sector now has a heavy commerce. Below Cincinnati there are eleven dams, only two of which are complete. The nine remaining dams are in varying stages of completion.

It has been decided definitely to defer the construction of the dam nearest the confluence of the Ohio and Mississippi until a trial has been given the maintenance of the channel by dredging. If this can be done without great difficulty or cost the dam will not be built.

A study is being conducted by the Federal Power Commission to establish the amount of the annual charge it would be reasonable to require for the use of the dam in the Ohio River at Louisville by the Louisville Hydro-Electric Company. The charge in this instance cannot be based on comparable precedents. The Louisville project is unique in that it has no primary power. For this reason it may be necessary to arrive at some arbitrary figure which will not discourage the development and at the same time give the government an adequate return for the use of its structure.

The Federal Power Commission on July 20 issued a preliminary permit to the Central Carolina Power Co., of Columbia, S. C., covering a project in Broad River. It is proposed to erect a 32-ft. dam at Forts Shoals and a 34-ft. dam just above the mouth of Little River. Primary power to the extent of 12,800 hp. will be developed. It is planned to install equipment capable of generating 38,400 hp.

Applications for license are to be filed at once by the Utah Power Co. covering the remainder of its plants on the Provo and Bear River and tributaries. A number of the Utah companies existing plants are technically in trespass on government lands, in that the authority granted a former owner could not be transferred legally.

Applications for license already are on file for some of the plants. Questions arose in the case of the remainder. Major Glenn E. Edgerton, the chief engineer of the Federal Power Commission, just has returned from Utah, where he visited the plants. A complete understanding was reached and it is believed that the licenses will be issued promptly.

Indiana Highway Commission Engineer Dismissed

Chesleigh Gray, chief engineer of the Indiana State Highway Commission has been dismissed by the commission. His dismissal is the result of a disagreement over the recently adopted policy of the highway commission which required that county road specifications submitted to it for approval must comply with those of the commission in every detail. Mr. Gray objected to the ruling as it made it necessary for him to disapprove the gravel specifications of Marion County, specifications which were more rigid than those of the commission and which, according to Mr. Gray, resulted in better highways. The specifications were the subject of attack by gravel dealers in Marion County as being so strict as to exclude local gravel from consideration. Mr. Gray did not hold this view and stated that to disapprove the specifications would be contrary to his better judgment.

Mr. Gray has been with the commission since its organization in 1919. He is succeeded by William J. Titus, bridge engineer of the commission.

More Big Improvements at Chicago

Track elevation, drawbridges and important street improvements along the terminal lines of the Santa Fe Ry., in Chicago, are provided by an ordinance passed by the city council and accepted by the railway company, the Sanitary District and the park commissions. Several streets which are now closed by railway right-of-way and tracks will be opened up by subways, while a new 120-ft. street fitting in with other improvements is provided by the vacation of certain railway property. By agreement between the city and the West Park Commission, street changes are to be made at the congested section where Western Ave. crosses the drainage canal; the present swing bridge is to be replaced eventually by two bascule bridges, one for boulevard traffic and the other for street cars and ordinary street traffic. The railroad company will pay the city for the occupation of certain streets.

More City Engineers Join in Plea for Increased Pay

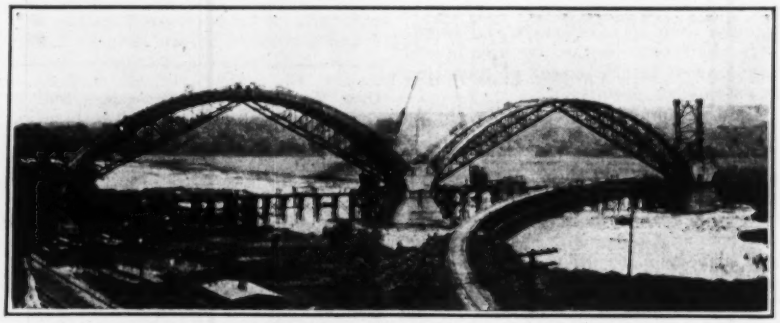
Following the lead of engineers in the employ of the city of Chicago in suspending work for half a day, as noted in our issue of July 9, p. 78, and of the engineers in the employ of the city of New York in organizing and asking for an increase in pay, engineers of Boston in the employ of the State of Massachusetts are now making a campaign for an increase in pay. Activity along this line has been stimulated by the announcement made by the committee on administration and finance that no salary increases are to be made to the employees of the State of Massachusetts this year. Most of the engineers are receiving less than $1,800 a year.

Strike Ties Up Municipal Work at Baltimore

As a protest against refusal on the part of the municipality to pay mechanics engaged on city work union wages, the Allied Building Trades Council at Baltimore has called a strike and claims that about 2,000 workmen have quit. The men were engaged on several projects being carried out by the city, including the construction of new school buildings and the repair of others. The city officials, at the opening of the strike, remained firm and declared that they could fill the places of all those who quit and the construction program would continue without interference.

Fourteen trades are affiliated with the Building Trades Council. In an effort to settle the differences existing representatives of the organization appeared before the Board of Estimates last week and requested that union wages be paid on all city construction work. The board refused to accede to the demand.

At the beginning of the strike it was declared that the city officials could fill all the places of those who quit and would make no further move until the effect of the strike is more apparent. Subsequent reports indicate that the strike is delaying some of the city work particularly school work which should be rushed.



Fort Snelling-Mendota Bridge Under Construction

THE BRIDGE between Fort Snelling and Mendota, Minn., when completed, will have 19 arches with piers carried to bed rock at an average depth of 70 ft. and a maximum of 85 ft. The pier foundations were built by the caisson method. In the picture shown above the steel centers are in place between piers 15 and 16, and the arch rib forms are completed and the concrete partly poured between piers 16 and 17.

Random Lines

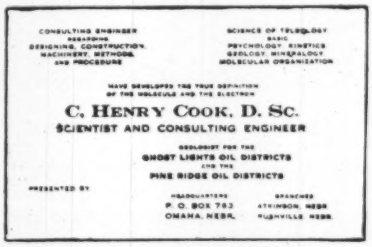
Just As We Thought the Supply Was Exhausted

Patent Engineer—"I would define a patent-engineer as a person who can design a new machine in accordance with a knowledge of patent law and of existing patents, just as intelligently as a mechanical or civil engineer designs a piece of mechanism or a structure in accordance with the laws of nature. A patent engineer is no more discouraged by a legal obstacle than a mechanical engineer is by a mechanical obstacle." Robert E. Naumberg in *The Tech Engineering News.*

Arrangement and Equipment Engineers—Glorified furniture movers who advertise for select banking clientele.

Diet Kitchen Engineer—A gentleman who is laying out part of a new hospital at Alton, Ill.

Consulting Criminal Engineer—One Maj. C. E. Russell. A correspondent suggests he might be couple with some "exterminating engineer," each to work on the other.



Telling the World

Engineering Candor.

Sir—A store at 2124 Lyndale Ave. So. in Minneapolis has in its two front windows an array of bottles containing liquids of various shades of brown. In one window a neatly lettered sign announces "MINNEAPOLIS BEVERAGE COMPANY." In the adjacent window a similar sign reads "MINNEAPOLIS EXTERMINATING ENGINEERS."

Would that all dispensers of "beverages" might show equal candor.

C. R. W.

Foreign Competition

Sir—Our knowledge of South America grows apace, especially since General Pershing has been designated to carry out the terms of the arbitration award in the Chile-Peru dispute.

In announcing that the Texas and Pacific Railway has awarded contracts for locomotives to the American Locomotive Company, the Baldwins, and Lima Locomotive Works, the headline in the New York *Times* of July 29th read: "Peruvian Company Shares Order with Baldwin and the American."

We shall have to look to our laurels. with these South American countries developing their manufacturing resources this way. F. L.

Seaboard Air Line Financing New Railroad Construction

Subsequent to the announcement that the proposed extension of the Seaboard Air Line Ry. to Miami, Florida, was virtually assured, as noted in our issue of July 30, 1925, p. 197, a bond issue of $25,000,000 was put on the market for that railroad. According to the announcement made in connection with the bond issue part of the proceeds will be used to reimburse the railroad's treasury for expenditures already made for new construction and part will be used to finance new construction. The new projects under consideration are the extension to Miami and on to Florida City, a distance of about 80 miles, and the extension of the Seaboard's west coast line from Arcadia to Fort Myers, a distance of 50 miles.

New Power and Refining Projects to Start Soon

Work on the large power development and manufacturing plant proposed by the Aluminum Co. of America in the Lake St. John region in Quebec, noted in our issue of July 23, p. 158, will be pushed, according to a press dispatch from Pittsburgh, where the stockholders of the company met and took the first action toward a merger of the Aluminum Co. of America with the Canadian Power & Mfg. Co. It is reported that another stockholder's meeting will be called soon to provide for a bond issue to finance the new development on the Saguenay River, which is expected to cost about $100,000,000. The manufacturing plant will be located near the head of navigation on the Saguenay River, a tributary of the St. Lawrence, so that bauxite coming from South America can be brought practically up to the plant by water.

Flow in Los Angeles Aqueduct Interrupted by Slides

Several interruptions to the flow of water in the Los Angeles aqueduct resulted from cloud bursts that occurred in the Owens Valley region during July, causing landslides that swept debris into open sections of the aqueduct or ruptured the conduit line. In all, ten sudden storms of a serious nature occurred.

The most serious slide, which occurred July 20, a short distance below Haiwee reservoir, filled the aqueduct for a length of about 1,000 ft. and reports from the job when the repair work was at its height stated that about 1,000 men and about 5 steam shovels were employed in removing the earth and boulders. William Mulholland, chief engineer of the water and power bureau, and H. A. Van Norman, city engineer, were in personal charge of the work and under their direction the men were worked in 4-hr. shifts in order to clear the obstructions with the minimum delay. By strenuous effort the aqueduct was reopened about five days after this slide. The city's water supply was maintained meanwhile from storage in other reservoirs nearer the city.

Hearing on Highway Bridges Over Arthur Kill

New York Port Authority Submits Its Plans to U. S. District Engineer —Navigators Object

Plans of the Port of New York Authority for two highway bridges across Arthur Kill, connecting New York and New Jersey in the Staten Island region, were before Col. Herbert Deakyne, district engineer, War Department, for public hearing last week. The plans cover two bridges, one crossing from Elizabethport, N. J., to Howland Hook, Staten Island, and the other crossing from Perth Amboy to Tottenville, at the southern end of the island. The former structure would have a channel span of 605 ft. between piers set just inside the pierhead line, while the southern bridge which crosses where the kill is about a quarter mile wide between harbor lines, would have several piers in open water, with a channel span of 675 ft. Both structures as designed are of cantilever type with horizontal bottom chord and top chord peak over the piers, for their main portions. The designs were prepared by J. A. L. Waddell, retained as consulting engineer for the structures by the Port of New York Authority.

Testimony presented by the engineers of the Port of New York Authority indicated that the traffic would be ample to pay the ferry charges and amortize the cost of the bridges, whose cost will probably be in the neighborhood of $15,000,000 or $16,000,000. Much objection was made by navigation interests, however, to the location of piers in the open water in the case of the Perth Amboy bridge, and demand was made for a channel opening of greater length, preferably the full width between harbor line. Much navigation passes up and down the kill, including tows of barges between the Raritan Bay industrial region and New York City, and oceangoing shipping to industrial points along Arthur Kill. Masters of vessels testified that navigation is difficult and dangerous at the point where the proposed Perth Amboy bridge is located, and that while the dredged channel at this point is only 400 ft. wide, barge tows are able to use a width of 900 ft. or more and under unfavorable tide and wind conditions require this full width and more to navigate the passage.

A decision of the War Department on the proposed clear width and height—both bridges as designed give a 135-ft. clearance height—is not expected for some time.

Arlington Memorial Bridge Bids to Be Called for About Sept. 1

Recent press statements to the effect that bids for the contract for the construction of the Arlington memorial bridge at Washington, D. C., are to be called for at once, are in error according to the executive officer of the commission. Plans and specifications for the piers and abutments are now being prepared and it is expected that this work will be ready for advertising about Sept. 1.

Railroad Authorized to Continue Operation of Boat Line

As a result of an application by several railroads which operate marine equipment in and around New York Harbor for a decision as to whether such operation was in violation of the Panama Canal Act, the Interstate Commerce Commission has ruled that the only part of such operation which comes under the provision of that act is that by the Central Railroad of New Jersey of a steamboat line to Sandy Hook. At the same time, the commission extended the time within which the railroad may continue the operation of this boat line.

The operations enumerated by the railroad companies included the passenger and vehicle ferries between the mainland and Manhattan Island, the car floats between the mainland and both Manhattan and Long Island, the lighters and barges operated by the railroads between their mainland terminals and various points about New York Harbor, and the steamboat line between Manhattan Island and Atlantic Highlands near Sandy Hook. The commission found that all but the last mentioned service were covered by the provisions of the Transportation Act and were not in violation of the portion of the Panama Canal Act which prohibits, under penalty, railroad ownership or operation of competing water carriers.

The Panama Canal Act, in order to prevent this prohibition working a hardship, provided that the Interstate Commerce Commission might extend the time in which such services were operated if they were found to be for the public benefit. In this case the commission found that the Sandy Hook boat line, which is operated by the New Jersey Central as an alternative to its ferry and rail route to points along the New Jersey Coast, has neither reduced nor prevented competition and is being operated in the interest of the public, and has therefore authorized its continued operation subject to further orders by the commission.

225-Mile Railway Planned to Run from Alabama Into Kentucky

The Florence, Clifton & Paducah Railroad Co. has applied to the Interstate Commerce Commission for authority to construct a new railway from Florence, Ala., through Tennessee to Paducah, Ky., a distance of approximately 225 miles and a branch line 25 miles long from some point in Wayne County to Savannah, Tenn. A. P. Campbell, of Florence, Ala., is given as the president of the railroad company.

Damage to Hetch Hetchy Plant Estimated at $50,000

Damage to the hydro-electric plant of the city of San Francisco, the Hetch Hetchy plant on Moccasin Creek, caused by the bursting of two penstocks, reported in *Engineering News-Record*, July 9, p. 78, resulted in damage amounting to $50,000.

Bridge Planned for First Narrows at Vancouver, B. C.

The proposal to build a bridge across First Narrows, the entrance to the port of Vancouver, B. C., to connect the cities of Vancouver and West Vancouver, has been revived and it appears now, as if some definite action would be taken toward financing and building the structure in the near future. Several designs for such a bridge have been prepared and one of them is given herewith. It was designed by H. D. Muckleston, consulting engineer, Vancouver, with whom was associated Dr. J. A. L. Waddell. The main span will

be about 900 ft. long and the cost is estimated at $2,800,000. The method of financing and building the bridge has not been determined. It is probable, however, that it will be built by private interests as a toll bridge, although there is some agitation for having it financed and built by the two municipalities.

Interstate Bridge Construction Meets Legal Difficulty

Several interstate bridge projects between Texas on the one hand and Louisiana and Arkansas on the other face indefinite delay in their prosecution because of an opinion just rendered by the attorney-general of Texas that state funds for interstate bridges cannot be applied beyond the state line. The question arose in the case of a bridge connecting Texas and Louisiana over the Sabine River, where a costly east approach must be built through a wide marsh area. Louisiana agreed to build this approach and Texas undertook to build the bridge. The new ruling may prevent the execution of the work under this agreement.

Georgia Students to Be Building Inspectors in Senior Year

Beginning next fall members of the senior class in the Department of Civil Engineering, Georgia School of Technology, will serve as building inspectors for the city of Atlanta, Ga., according to plans worked out by the School of Technology and the Atlanta Safety Council. The inspection will be done as part of a regular course in building instruction which will be offered to seniors only, and will be classed as a four hour laboratory course. Students will be divided into groups of two or three under the direction of a competent instructor, some prominent local engineer or an engineer of the Southeastern Underwriters Association.

State Takes Over Maintenance of Roads at Gettysburg Battlefields

The Pennsylvania State Highway Department has taken over the maintenance of the roads in the Gettysburg battlefield area. Maintenance of these roads, heretofore, has been carried on by the Federal Government.

Engineering Societies

Calendar

Annual Meetings

NEW ENGLAND WATER-WORKS ASSOCIATION, Boston, Mass.; Annual Convention in connection with trip on St. Lawrence River, Sept. 8-11, 1925.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Fall Meeting, Montreal, Que., Canada, Oct. 14-16, 1925.

AMERICAN PUBLIC HEALTH ASSOCIATION, New York City; Annual Convention, St. Louis, Mo., Oct. 19-22, 1925.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, Lakeland, Fla.; Annual Meeting, Des Moines, Iowa, Oct. 26-30, 1925.

Personal Notes

C. S. KIRKPATRICK, chief engineer of the Gulf Coast Lines, Houston, Texas, has had his jurisdiction extended over the International-Great Northern Ry., control of which has been acquired by the former road. F. S. SCHWINN, formerly chief engineer of the latter road, is now assistant chief engineer of the combined system.

HENRY H. GLADDING, assistant city engineer for 42 years and in charge of street construction, New Haven, Conn., has retired from service. Mr. Gladding entered the city's service in 1883; one of his first services was the systematization and completion of street layout records.

C. E. STAHL has been appointed division engineer of the Kansas State Highway Commission, with headquarters at Norton; Mr. Stahl's previous service was with the Missouri State Highway Commission and in county work in Minnesota. J. A. ROBY has been appointed division engineer, with headquarters at Garden City; he was formerly resident engineer on highway work in Montgomery County, Kansas. C. F. ZEIGLER in Division 2, IRA ROGERS in Division 4, and ROBERT JUSTICE in Division 5 are appointed assistant division engineers. A. D. CONROW, for many years assistant steel testing engineer, has been appointed materials engineer, and TOM BURTON has been

appointed chief of plans, having previously been a resident engineer in Sedgwick County. All the above are recent appointments of the Kansas State Highway Commission.

FRANK H. CLARK, technical adviser to the Ministry of Communications of China with headquarters at Peking, is at present visiting and making studies in this country, staying at the Engineers' Club at New York. He will be here about two months. Mr. Clark was formerly superintendent of motive power of the Baltimore & Ohio R.R. He is preparing specifications and new designs for cars and motive power for Chinese Government railways. He went to China in 1919. His present trip is incidental to attendance upon the meetings of the International Railways Conference in England this summer.

Obituary

EUGENE E. DAVIS, superintendent of the water-works system at Richmond Va., and an employee in the city's service for 55 years, died July 20 at his home in his 75th year. Starting as a plumber in 1872, when his father, James L. Davis, was superintendent of the Richmond water-works, he gradually advanced to the position of superintendent in 1908. Mr. Davis was a regular attendant at the conventions of the American Water Works Association.

Civil Service Examinations

UNITED STATES

For the following civil service examinations, apply to the U. S. Civil Service Commission, or to any local office of the Commission.

Assistant Structural Engineer — Vacancy in the Supervising Architect's office, Treasury Department, Washington, D. C., at entrance salary of $2,400, with advancement to $3,000, and vacancies in positions requiring similar qualifications; duties mainly connected with engineering construction, particularly fireproofing and reinforced-concrete work; candidates not to take an examination but to be rated on education, training and experience.

Chief Illustrative Draftsman — Vacancy in position as artist draftsman at the Signal School, Camp Alfred Vail, N. J., at salary of $3,600, and vacancies in positions requiring similar qualifications as they may occur; duties are direction of other draftsmen, developing accurate scientific illustrations in sketching and color and photographic work, constructing military technical diagrams, making intricate statistical and organization charts, map lettering; applicants not to take set examination but to be judged by education, training, experience, specimens of work, and general fitness.

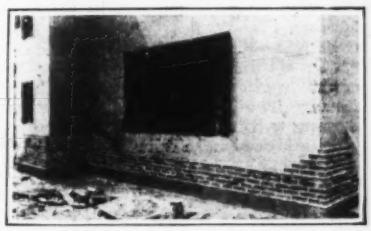
Applications for both the above-named positions will close on September 1.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Data on Cost of Sheathing with Gypsum Lumber

Data as to the cost of sheathing a frame house with Gyp-Lap fireproof gypsum sheathing lumber are made available by contractors who have used the new board through its manufacturers, the United States Gypsum Co.



GYPSUM BOARD USED ON RESIDENCE OF BRICK VENEER CONSTRUCTION

Tests have been conducted by building code officials and improvements have been made in the material since it first was put on the market last fall. At that time its construction was closely similar to Sheetrock wallboard. Its manufacture has been changed so that now the board is ½-in. thick instead of ⅜ in. as at first and it has a different extra-heavy waterproof covering. It is said to be the only gypsum board manufactured with interlocking groove edges which prevent wind-infiltration.

Cost data were submitted as follows by the Cadenhead Co., general contractor, on the placing of gypsum sheathing as a backing for brick veneer on a $50,000 residence at Glencoe, Ill.:

3,000 sq.ft. gypsum board at $45 per M	$135.00
96 hr. carpenter-labor at $1.25 per hr.	120.00
100 lb. of 6 d. common nails	3.85
Total	$258.85

The total waste of gypsum board was stated to be 1 per cent. The installation cost on this residence was somewhat high, since all but seven boards had to be cut to fit. As compared with these figures, the Cadenhead Co. submitted the following estimate of what it would have cost to do the same job with wood sheathing on the basis of its customary experience:

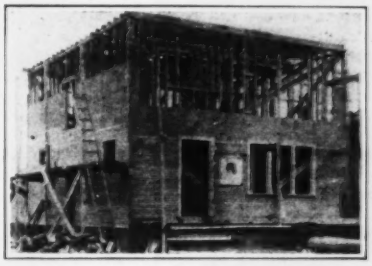
3,600 sq.ft. 1 x 6 Y.P. sheathing, $42 per M	$151.20
144 hr. carpenter-labor at $1.25 per hour	180.00
120 lb. 8 d. common nails	4.50
3 rolls black building paper at $3.75 per roll	22.50
Labor for applying the paper at $1.25 per roll	7.50
Nails for the paper at 10 cents per roll	.60
Total	$366.30

On the basis of these figures there was realized a saving of approximately 30 per cent by using the gypsum board in place of the common lumber.

The Mertz Construction Co., Indianapolis, in constructing a residence with brick veneer exterior, reported that two carpenters put on 2,000 sq.ft. of gypsum board in 9 hr., or at the rate of 111 sq.ft. per man per hour. It was estimated that the labor cost ran about 1 cent per square foot.

H. Waddell, contractor, Rockford, Ill., states that two carpenters applied 1,300 sq.ft. of gypsum board sheathing in 11 hr., or at the rate of 118 sq.ft. per hour. This sheathing was used as a background for a stucco covering.

Francis F. Hamilton, commissioner of buildings, Indianapolis, recently made some tests to determine the rigidity of construction using gypsum sheathing boards. Two test-panels, both 8 x 7 ft., were built of 2 x 4 studs, spaced 16 in. on centers. On one panel frame, the studs were covered with 1 x 6 No. 2 Y.P. sheathing, while on the other, gypsum board was used. The two panels then were attached to the same heavy sill with their ends 2 ft. apart. A building jack was inserted between the ends of the panels and was turned so as to force them apart. At full extension of the jack, it was found



GYPSUM BOARD USED IN CONVENTIONAL FRAME BUILDING CONSTRUCTION

that the deflection of the wood-sheathed panel was six times as great as the deflection of the one sheathed with gypsum board.

The chief advantage of the use of gypsum board lies in the fact that it performs the functions of four materials. It is not only a firestop and insulator, but also eliminates the need of building paper, and can be used as a sheathing or backing with any system of residence construction.

Business Notes

THE CONTINUOUS TRAIN CONTROL CORPORATION, New York City, and Detroit, Mich., has been awarded a contract for a trial installation of its semi-continuous automatic train-control which might be termed the wired wireless inductive type or invisible ramp, on

the Michigan Central R.R. main line, between Jackson and Albion, Mich., a distance of approximately 20½ miles of double track. The automatic train-control will be the simple stop with two-position cab indication—"clear" and "danger." It is to be co-ordinated with the automatic block signalling system which now exists on this road. The locomotive equipment is operated by the pick up of electromagnetic wave energy at different wave lengths for each indication through a gap 8 or 10 in. above the rails.

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, has recently opened branch offices at Tampa, Fla., and Chattanooga, Tenn. J. C. Boesch is manager of the Chattanooga office, while W. L. Southwell, formerly merchandising manager at Atlanta, is manager of the Tampa office. In addition to these changes, W. W. Ballew, formerly manager of the central station division will be manager of the Atlanta office.

UNIVERSAL PIPE & RADIATOR CO., New York, has acquired control of B. Nicoll & Co., importers of Pont-a-Mousson French cast-iron pipe. John H. White, president, B. Nicoll & Co., has been made president of Universal Pipe & Radiator Co. Under this new arrangement, B. Nicoll & Co. will function as a subsidiary of Universal Pipe, handling the foreign products.

STRUCTURAL STEEL & FOUNDRY CO., Salt Lake City, Utah, will soon open a plant in Salt Lake City for the fabrication of structural steel and the manufacture of a complete line of coal and metal mining and sugar making machinery, heavy forgings and iron and steel castings. This plant, it is said, will be the only complete forging plant outside those maintained by the railroads, between Denver and the Coast. The new concern has purchased the plant of the Salt Lake Boiler & Sheet Iron Works, in addition to adjacent territory for switching and erection operations. The total investment in land, buildings and equipment will be approximately $200,000. The officers of the Structural Steel & Foundry Co. are: Thomas F. Pierpont, president; Simon Rosenblatt, president of the American Foundry & Machine Co., vice-president; Henry D. Moyle, treasurer; P. A. Mattingly, general manager of the American Foundry & Machine Co., secretary, and O. W. Waterman, sales manager. The above officers, together with Clifford S. Pierpont, form the board of directors.

HOOSICK FOUNDRIES, INC., Hoosick Falls, N. Y., has recently been incorporated; its predecessor was the Hoosick Malleable Iron Works established in 1880. The new concern has purchased the plant of the Walter A. Wood Mowing & Reaping Machine Co., and will operate its malleable and grey iron foundries and machine shops. The officials of the Hoosick Foundries are: president, Henry Burden of Cazenovia, N. Y.; vice-president and general manager, F. H. Fowler; secretary and treasurer, William C. Feathers.

CONSOLIDATED EXPANDED METAL CO., Braddock, Pa., announces the appointment of H. E. Hollingsworth to the position of New York branch manager to succeed Thomas R. Herbest, Jr., who leaves to assume the duties of vice-president and director of sales at the home office.

Equipment and Materials

New Light Weight Transit for Reconnaissance Work

A new transit weighing only from 9 to 10 lb., but built for hard usage, is announced by W. & L. E. Gurley, Troy, N. Y. The metal used in its construction is claimed to have one-third the weight and twice the strength of bronze. The leveling head is of the four-screw type, the screws being of nickel-alloy with bakelite heads; there

is a $\frac{5}{16}$-in. movement to the shifting center.

The compass is complete in itself, has a 3½-in. needle and is attached to the plate by three screws making it easily removable. The circle is divided to half deg. and is movable for setting off magnetic declination opposite an index. The standards are made from a new design consisting of two A-shaped pieces with enlarged feet. The 8½-in. telescope has a magnifying power of 19, a minimum focus of 4½ ft., contains platinum cross and stadia wires and balances at average working focus with sun shade attached. Stadia ratio is 1:100. The horizontal limb is 5 in. in dia., graduated 0 to 360 deg. both ways, and setting is secured by a double vernier reading to single minutes at 11 deg. to line of sight. The vertical limb is also 5 in. in dia., either full or half circle, figured in quadrants and reading to single minutes. The tripod is interchangeable with all new Gurley precise transits and levels.

Concrete Floors Colored and Hardened in One Operation

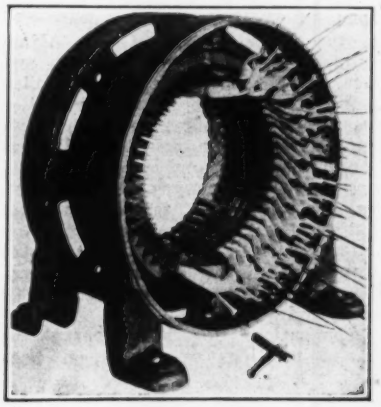
A substance in paste form for adding to concrete mixtures is claimed to both color and harden the concrete. It is known as "R.I.W." colored integral hardener and is manufactured by Toch Bros., New York.

In addition to its coloring and densifying properties, this substance is claimed to improve the wearing qualities of a floor and to waterproof it to some extent; furthermore it does not affect the tensile or compressive strength of the cement topping in which it is incorporated. It is available in terra cotta, red, brown, willow green, sea green, dark slate and other alkali-proof shades. This product can be used to advantage in hospitals, solariums, churches, schools, office buildings, residences, swimming pools and similar structures.

Electric Motor Uses Welded Steel Shapes Instead of Castings

Through the application of its "Link-Weld" process of electric arc welding, the Lincoln Electric Co., Cleveland, Ohio, has perfected a motor using welded steel shapes instead of castings. This construction is claimed to produce a motor of lighter weight, more durable quality, better ventilation, and no greater cost than the common style of motor.

The motor end rings or frame are made from a standard steel angle, first rolled into circular shape, and the abutting ends welded. This construction forms small obstruction to the passage of air, a feature which is claimed to contribute to the motor's ability to stand overloads. The stator is made of thin steel sheets which are stacked and hot riveted together while under pressure between the two steel end rings. This method of construction is only possible with steel shapes and there is small possibility of the laminations coming loose. The rotor laminations are also placed under pressure and hot riveted. The rotor end rings are made of copper bent into a circular shape and welded. The winding and rings are



next welded together. Other applications of the welding process include the fastening of the ventilating vanes to the rotor plate and the construction of the oil rings. Drop forged steel feet are used on the motor and are electrically welded to the motor end rings.

New Hand Saw Uses an Electric Motor

A portable electric circular hand saw has been placed on the market by the Crowe Manufacturing Corp., Cincinnati, Ohio, and is known as the Crowe safety saw. The body of the tool is made of aluminum which makes it light in weight and easy to handle. The motor, manufactured by General Electric Co., can be supplied for

either 110 or 220 volts. The saw is equipped with a trigger switch for economy and to insure safety. The motor fan and shafts are dynamically balanced in order to eliminate vibration in operation. It is provided throughout with heavy-duty ball bearings.

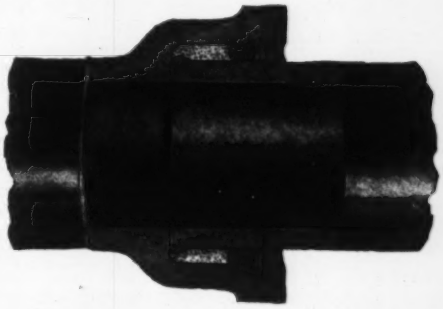
The smaller size weighs 15 lb., has a cutting capacity, with an 8-in. blade, of 2½ in.; the larger size which weighs 25 lb. will cut lumber 4½ in. thick, and has a 12-in. blade.

New Gas-tight Joint Seal for C. I. Bell and Spigot Pipe

The Bigler ring for high pressure gas joints which has just been put on the market is an invention by F. R. Bigler, purchasing agent for the Kansas City Gas Co., Kansas City, Mo. The invention is an improvement in the packing for use between the spigot and the bell of a cast iron pipe line and permits the use of such pipe for high pressure gas transmission mains. Heretofore, cast iron pipe has not satisfactorily carried even low pressure gas.

The Bigler rubber ring is hollow and larger in diameter than the annular space in the stuffing box which is formed when the spigot of a pipe is entered into a bell. This places the rubber ring under initial pressure when it is calked into the joint. The seal is made by the rubber ring, the lead and jute merely serving to hold it in place.

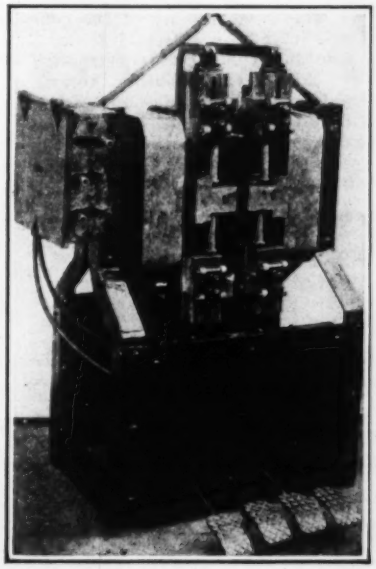
The best practice is to fill a joint with jute to the extent that the rubber ring will rest about halfway past the lead groove. In this position one-half of the ring is under more compression than the other half which has expanded



into the lead groove. Thus the ring can be placed under additional compression at any time by calking on the face of the joint. It is claimed that the field construction with the joint is both speedy and economical. Furthermore, cement may be used in place of lead to hold the ring in place. The lead may be either poured into the joint or used as cold lead strips; jute may be either dry or treated.

Electric Rivet Heaters for Structural Work

New designs of electric rivet heaters which are being introduced by the American Hoist & Derrick Co., St. Paul, Minn., include the four-rivet stationary machine, shown in the illustration, which is intended especially for structural work. The sliding jaws and block which hold the rivets are of solid cast copper and have thirty times the current carrying capacity of a 1-in. rivet, so that it is said to be impossible to overheat the rivet to a dangerous degree, while the construction is such that magnetic losses are practically eliminated and current consumption is reduced to a minimum. Rivets up to 9-in. long can be inserted. In a test, 25 rivets ¾x2½ in. were heated in a four-rivet stationary machine in 2 min. 40 sec. (less than seven seconds each) with a current consumption of only 3.28 kw. This machine weighs 1,900 lb.



A two-rivet 2,300-lb. machine for boiler work is equipped with adjustable side contacts under control of the operator, so that the grip of the rivet can be raised to a white heat while the end and head are left at proper temperature for driving, thus insuring that the rivet will completely fill the hole. A two-rivet portable machine is also manufactured. It is mounted on a truck, equipped with a 44-ft. electric cable and weighs 1,100 lb. All the machines operate on alternating current of any voltage and are equipped with the maker's interlocking heat control apparatus, located conveniently at the operator's left hand giving him instant control of the current. The double-deck arrangement in the four-rivet machine saves floor space, and the heaters are always ready for use by simply turning on the current. With the absence of heat in all parts except the rivet, there is no discomfort or chance of burning the men.

Publications from the Construction Industry

Pivoted Window Sash—DAVID LUPTON'S SONS CO., Philadelphia, in its new catalog No. 12-A, gives complete details including photos, drawings, descriptions and specifications for its pivoted copper-steel window sash in types suitable for any wall opening. Illustrations are given of a number of typical examples in different types of factories and office buildings. Information is given in the catalog on the operating devices for the window sash and also on the standard steel doors manufactured by this company.

Wood-Block Floors — COMPRESSED WOOD PRESERVING CO., Cincinnati, has issued a new pamphlet describing its creosoted wood blocks for factory floors. A list of well-known factories employing this type of flooring is also given.

Floor Surfacer and Polisher—ELECTRIC ROTARY MACHINE CO., Chicago, describes in a new bulletin its electric rotary machine which by means of a change of attachments is adaptable to surfacing and polishing marble, tile, mosaic, and cement floors. In addition, there are attachments for surfacing side walls, wainscoting, stairs, etc.

Pumps and Turbines — DEAN HILL PUMP CO., Anderson, Ind., has ready for distribution its catalog No. 125 describing its complete line of centrifugal pumps and steam turbines.

Chlorinating Apparatus — PARADON ENGINEERING CO., Long Island City, N. Y., has issued bulletin No. 13 describing its line of chlorinating apparatus. A list of some of the present installations of the apparatus and the data required from a customer when ordering are also given.

Engineering News-Record Statistics of the Construction Industry

August 6, 1925 — *in the United States* — Vol. 95, No. 6

Engineering News-Record CONSTRUCTION COST Index Number (1913 = 100)

MONTHLY

Jan. 1924 to Date

August, 1925	204.60
July, 1925	204.60
August, 1924	213.15
Peak, June, 1920	273.80
1913	100.00

1924

Jan.	217.90	May	222.33	Sept.	211.25
Feb.	220.30	June	216.85	Oct.	207.55
March	224.60	July	214.40	Nov.	205.70
April	221.60	August	213.15	Dec.	208.58

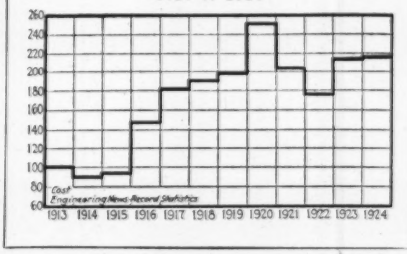
1925

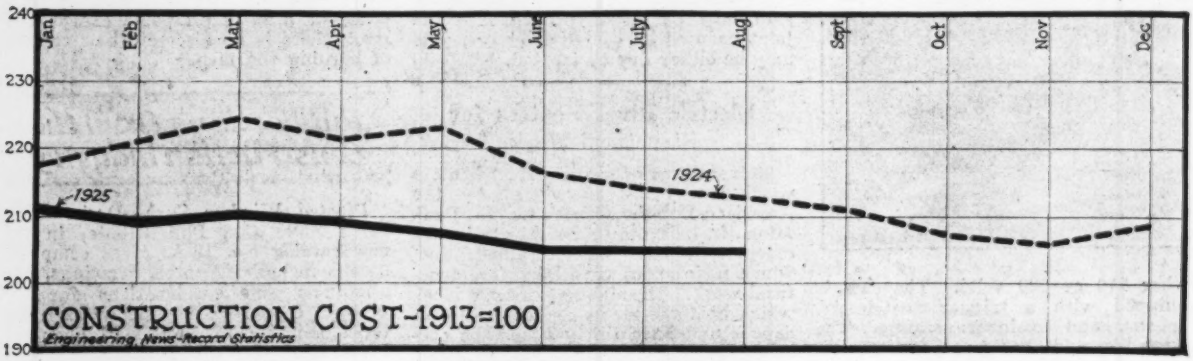
Jan.	210.40	April	209.55
Feb.	209.70	May	207.20
March	210.20	June	204.60

ENGINEERING NEWS-RECORD'S Construction Cost Index Number remains unchanged from the June 1 level, owing to lack of fluctuation in prices of basic building materials and labor. The average rate for common laborers is 53c. per hr. for the entire country. The same rate prevailed two months ago as against 56c. per hr. in August, 1924. Thus general construction cost is 4 per cent lower than one year ago and 25 per cent under the peak; it is 105 per cent above the 1913 level.

YEARLY

1913 to 1924





Engineering News-Record CONSTRUCTION VOLUME Index Number (1913 = 100)

MONTHLY

Jan. 1924 to June, 1925

July, 1925	178
June, 1925	214
July, 1924	161
Peak, May, 1922	221
1913	100

1924

January	125	May	194	September	159
February	144	June	149	October	164
March	161	July	161	November	128
April	159	August	162	December	145

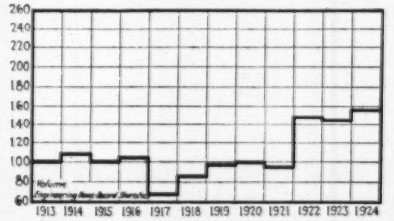
1925

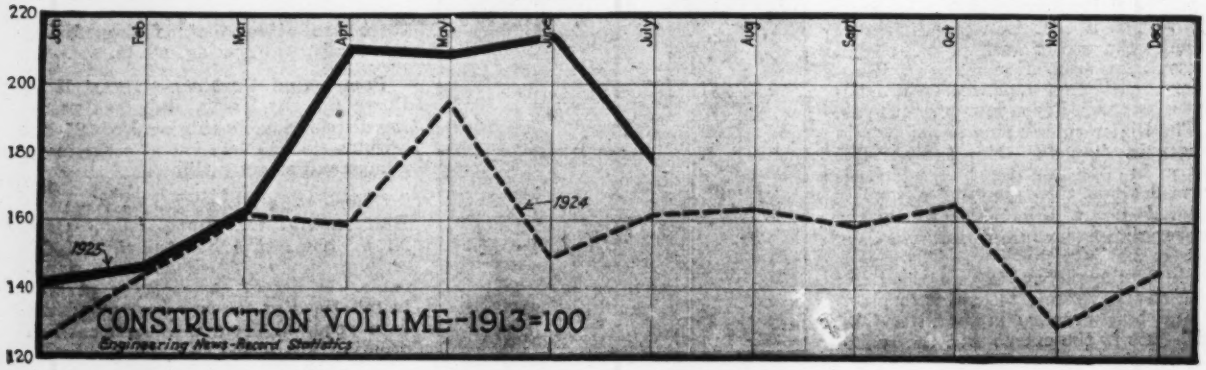
January	141	March	161
February	145	April	211
	May	209	

ENGINEERING NEWS-RECORD'S Construction Volume Index Number is 178 for the month of July, and 154 for the whole of 1924, as against 100 for 1913. This means that the actual volume of construction in 1924 (not the mere money-value of the contracts let that year) is 54 per cent above the volume of construction for 1913. The monthly volume number, 178 for July, 1925, contains the increment of construction and indicates the rate at which contracts are being let as compared with 1913 awards.

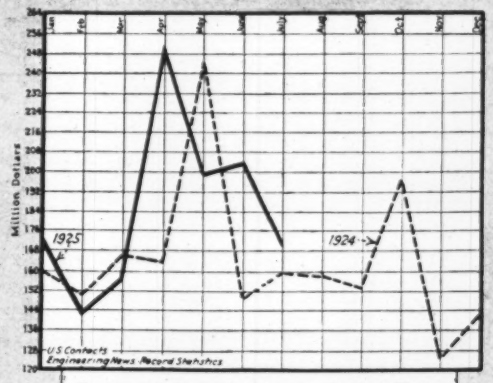
YEARLY

1913 to 1924

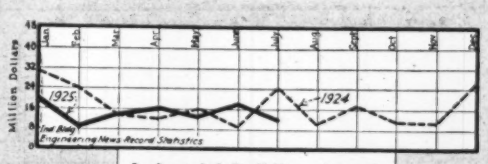




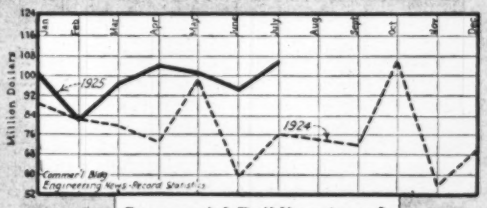
Monthly Statistics of the Construction Industry



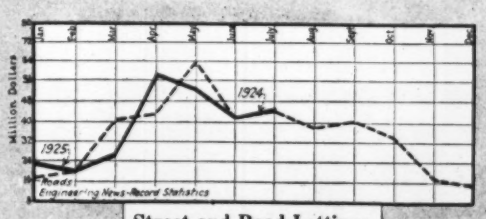
Contracts Awarded in the United States
Reported in E. N.-R.



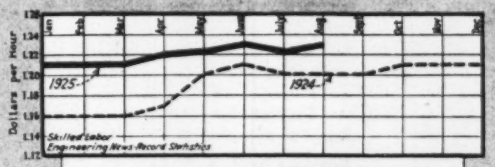
Industrial Building Awards
$40,000 and Over



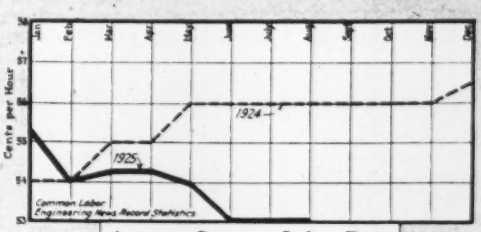
Commercial Building Awards
$150,000 and Over



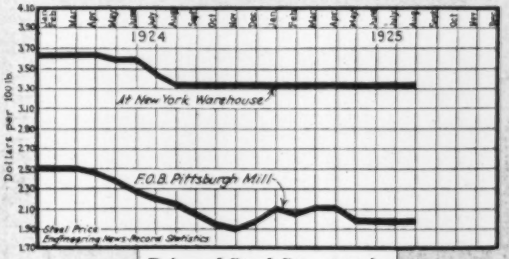
Street and Road Lettings
$25,000 and Over



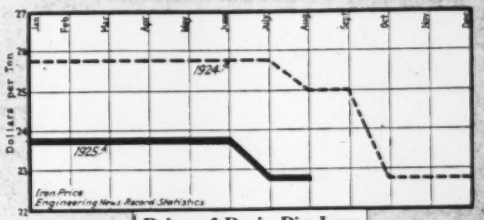
Average Wage of Skilled Building Trades
Bricklayers, Carpenters and Steel Erectors



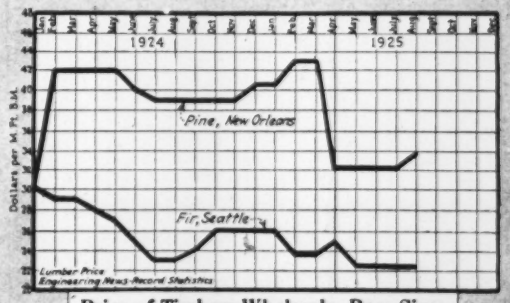
Average Common Labor Rate
Pick and Shovel Men



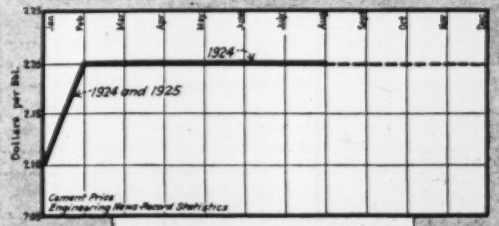
Price of Steel Structurals
Shapes 3-In.; Plates ¼-In.



Price of Basic Pig Iron
F.o.b. Pittsburgh

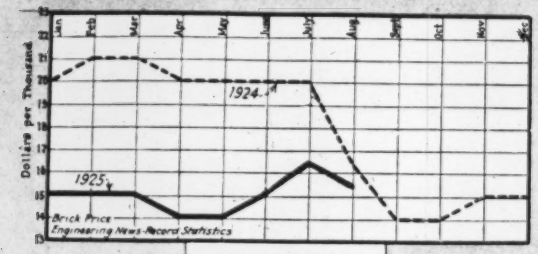


Price of Timbers, Wholesale, Base Sizes
Car Lots to Contractors

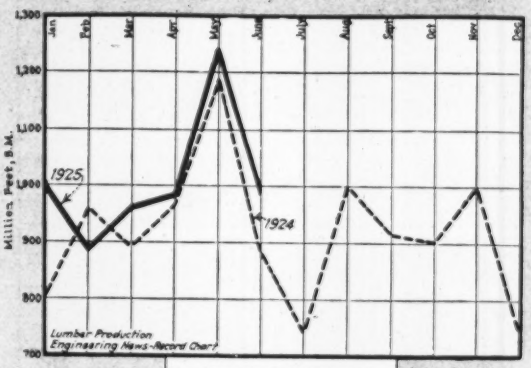


Net Price of Portland Cement
Car Lots, F.o.b. Chicago

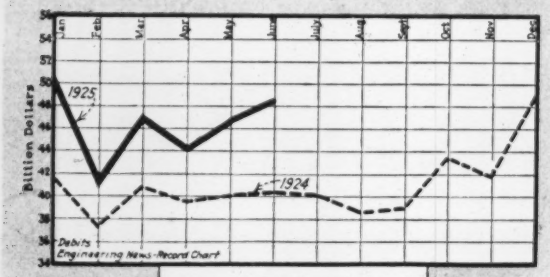
Monthly Statistics of the Construction Industry



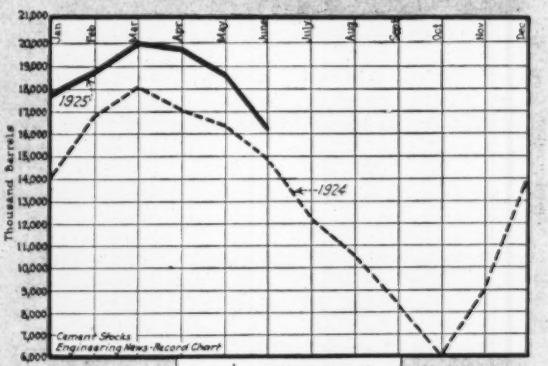
Price of Brick
At Dock, New York



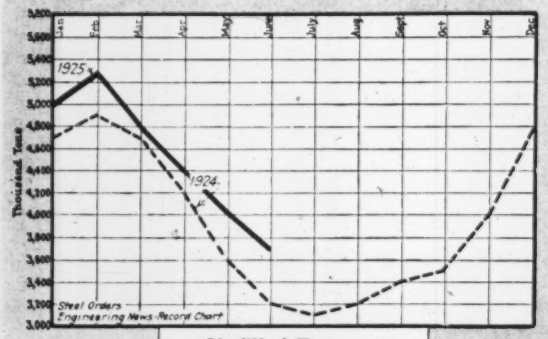
Lumber Output
Nat. Lumber Mfrs. Assn.



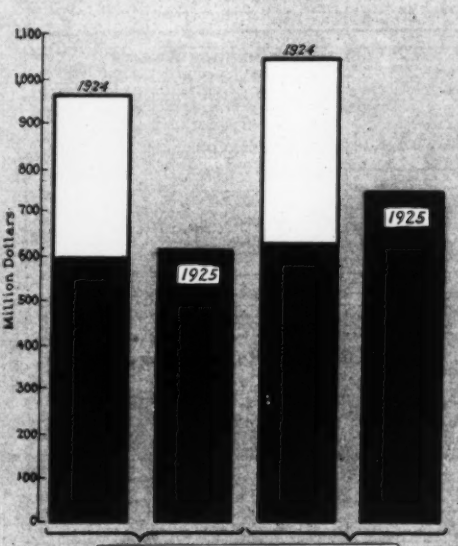
General Business Trend
Bank Debits—Federal Reserve



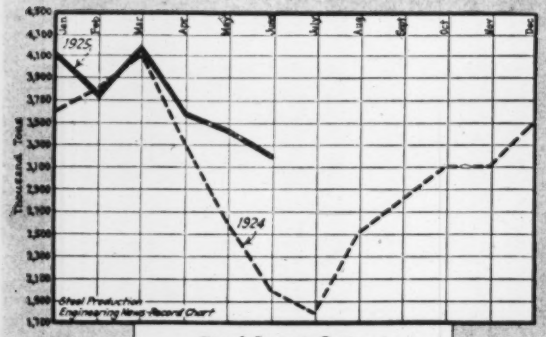
Cement Mill Stocks
Geological Survey



Unfilled Tonnage
On Books of U. S. Steel Corp.



Public—Contracts—Private
Jan. 1 to date
Reported by E. N.-R.



Steel Ingot Output
Gross Tons; Am. Iron and Steel Inst.

Construction Awards, Jan. 1 to Date, 10 Per Cent Ahead of Same Period Last Year—Trend Toward Commercial Buildings, Public Works and Utilities

CONTRACT letting on large engineering construction projects during July, was over 6 per cent ahead of the corresponding period in 1924 in money value of awards.

In actual physical volume (quantities of materials used) as represented by the E. N.-R. Construction Volume Index, July reached 178, compared with 161 for the same month last year, 1913 equalling 100.

This year, Jan. 1 to date, is over 10 per cent ahead of the corresponding period of 1924 in money value of contracts let. Furthermore, 1925 has kept consistently in the lead from the start and now at the beginning of the eighth month, promises to develop into the record construction year.

The outlook for construction activity is most promising in the Middle Atlantic states and territory between the Mississippi and the Pacific coast.

The trend is toward expansion in commercial buildings, waterworks, sewers, streets, roads and other public projects and away from speculative housing construction and further enlargement of factory and mill capacity.

Minimum costs observed in the table below are: Water-works and excavations, $15,000; other public works, $25,000; industrial buildings, $40,000; commercial buildings, $150,000.

The twelve largest projects awarded during July were: an office building, Chicago, Ill., $7,000,000; bank and office building, New York, N. Y., $4,000,000; church and office, New York, N. Y., $4,000,000; legislative hall, Olympia, Wash., $3,176,000; pier, Jersey City, N. J., $3,000,000; temple, Dayton,, O., $2,000,000; dam, Glenmore, N. Y., $1,500,000; sewer, Kansas City, Mo., $1,266,508; clubhouse, San Francisco, Calif., $1,250,000; subway, Jersey City, N. J., $1,176,601; steel mill, East Youngstown, O., $1,000,000; store, Minneapolis, Minn., $1,000,000.

Business Briefs

Call money quoted at 4½@4¾ per cent, Aug. 4; year ago, 2 per cent.

Time loans, short periods, 4½@4¾ per cent; longer periods, 4½@4¾ per cent.

FOREIGN EXCHANGE (DEMAND)

	Par	This Week	Last Week	Year Ago
Sterling	$4.86⅔	$4.85 7/16	$4.85 11/16	$4.45⅛
Franc	.193	.0471½	.0472½	.0541
Lira	.193	.0364½	.0365½	.044
Mark	.238	.2382	.238	
Florin	.402	.4019	.4013	.3859
Peseta	.193	.1445	.145	.1344
Krona	.268	.2687	.2686	.2662

Value of Contracts Let in the United States and Canada, July, 1925

	New England	Middle Atlantic	Southern	Middle West	West of Mississippi	Far West	United States	U. S. Jan. 1 to Aug. 1	Canada
Water-works	$368,000	$1,846,000	$307,000	$923,000	$714,000	$1,492,000	$5,650,000	$38,177,000	$236,000
Sewers	197,000	2,352,000	317,000	2,063,000	845,000	498,000	6,272,000	40,806,000	288,000
Bridges	84,000	94,000	918,000	1,234,000	907,000	597,000	3,834,000	38,655,000	25,000
Excavation, dredging, etc		168,000	310,000	111,000	183,000	1,099,000	1,871,000	7,916,000	123,000
Streets and roads	2,623,000	10,693,000	5,207,000	9,971,000	11,063,000	5,689,000	45,246,000	269,363,000	2,623,000
Industrial building	2,040,000	1,558,000	80,000	4,100,000	4,005,000	175,000	11,958,000	100,793,000	3,165,000
Commercial building	8,970,000	38,512,000	3,256,000	19,528,000	15,106,000	20,746,000	106,118,000	707,148,000	332,000
Federal government	72,000	302,000	803,000	177,000	521,000	687,000	2,562,000	22,223,000	
Unclassified	92,000	22,815,000	1,666,000	1,442,000	2,162,000	1,005,000	28,582,000	131,510,000	778,000
July, 1925	$14,446,000	$78,340,000	$12,264,000	$39,549,000	$35,506,000	$31,988,000	$212,093,000	$1,356,591,000	$7,570,000
July, 1924	15,296,000	70,646,000	27,811,000	50,847,000	22,747,000	11,932,000	199,279,000		2,816,000
June, 1925	20,508,000	57,691,000	23,870,000	33,993,000	39,818,000	27,599,000	203,479,000		8,515,000
1925, Jan. 1 to Aug. 1	**114,459,000**	**465,530,000**	**109,453,000**	**242,554,000**	**245,603,000**	**178,992,000**	**1,356,591,000**		**47,824,000**
1924, Jan. 1 to Aug. 1	76,574,000	392,206,000	145,434,000	261,037,000	191,597,000	159,461,000	1,226,309,000		60,163,000

Labor Rates and Conditions Throughout the Country

WITH the year nearly two-thirds gone, a comparison of general business conditions with those of the corresponding period in 1924 yields a very favorable outlook for the remaining months.

Construction, cement shipments, revenue freight loadings and bank debits are all at record levels.

Other signs of assurance are: improvement in wholesale and retail trade; gain in exports over imports, particularly in manufactured goods; ample credit; expectation that prices in the security market will hold; lessened total money value of liabilities; greater total dividends; higher average prices of stocks and bonds; gain in railway net operating income; decrease in excess of gold exports; increased iron-ore shipments; heavier production of pig iron, steel ingots and cement; better steel buying, particularly in plates and structurals; increased output in the automotive industry; greater lumber production and demand; improvement in the agricultural outlook, particularly with regard to corn and wheat.

Retarding factors, active at present but not sufficiently strong to offset the favorable influences, are as follows: adverse foreign conditions; increasingly greater amounts of capital required to finance business and industry; gain in wholesale prices of general commodities; increased cost of living, due mostly to rise in price of fuel, food and clothing; labor troubles, such as the present jurisdictional dispute between bricklayers and plasterers and the threatened coal strike; increasing unemployment in the iron and steel, automotive, coal mining, textile and leather industries; wage reductions in the textile mills; anticipated cotton yield smaller than last year.

In general, the construction industry is stronger now than ever before. Locally (by districts) conditions are as follows:

Atlanta—Extensive building program in operation. Small surplus of building trades mechanics.

Baltimore—Strike threatened on all city construction work; will probably involve 2,000 to 3,000 men. Action resulted from refusal of employers to grant union rates.

Birmingham—Building active; slight surplus of labor; bricklayers and plumbers scarce.

Boston—Electrical workers on strike since July 6 over refusal of employers to grant wage increase. Engineers in municipal employ demand wage increase.

Chicago—Bricklayers and plasterers scarce. Excess of common laborers. Building continues active. Engineers in municipal employ granted increase in wages.

Cincinnati—Construction proceeding at rapid pace. Some unemployment reported.

Cleveland—No shortage of building trades mechanics and no unemployment among workers of this class. Surplus of factory help.

Dallas—Small surplus of pile drivers, common laborers, painters and iron workers.

Denver—Extensive construction program employing all local skilled labor; surplus of unskilled.

Detroit—Normal conditions prevail in the building trades. Demand sufficient to absorb skilled mechanics.

Kansas City, Mo.—Building slower; skilled mechanics plentiful; no marked unemployment.

Los Angeles—Slightly more than enough building trades mechanics with exception of tile setters, bricklayers and marble workers. Construction active.

Minneapolis—All local building trades craftsmen employed. Slight excess of unskilled common laborers.

Montreal — Unemployment situation

Current Building Trades Wage Rates Per Hour

(Higher rates indicated by +, decreases by —)

Cities	Bricklayers	Carpenters	Hoisting Engineers	Hod Carriers	Pile Drivers	Structural Iron Workers	Common Labor
Atlanta	$1.12½	$0.70	$0.70	$0.50	.....	$0.75	$0.25@.30
Baltimore	1.50@1.75	1.00@1.20	1.00@1.12½	1.00	$0.65	1.12½	.40
Birmingham	1.00@1.50	.35@.87½	.75@1.25	.50@.75	.....	.75@1.75	.20@.40
Boston	1.25	1.10	1.10@1.30	.70@.75	1.10	1.10	.50@.75
Cincinnati	1.50	1.25	1.25	.92½	1.25	1.25	.40@.55
Chicago	1.50	1.37½	1.37½	.87½	1.37½	1.37½	+ .82½@.87½
Cleveland	1.50	1.25	1.30	.87½	1.00	1.50	.87½
Dallas	1.50	1.00	1.00	.40@.75	.87½	1.00	.30@.50
Denver	1.62½	1.12½	1.12½@1.18¾	.81¼@.87½	1.00	1.15¾	.35@.55
Detroit	1.50	.70@1.00	.85@1.00	.90	.85@1.00	1.12½	.50@.60
Kansas City	1.37½	1.12½	1.12½@1.25	.90	1.25	1.12½	—.30@.60
Los Angeles	1.25	.87½	.75	.75	.75	.87½	+.50
Minneapolis	1.12½	.87½	.87½	.71½	.....	.87½	.50@.55
Montreal	.90	.45@.65	.62½	.30@.35	.50	.65	.25@.30
New Orleans	1.25	.90	1.00	.65	.85	1.25	.35@.40
New York	1.50	1.31¼	1.50	1.00	1.00@1.12½	1.50	.50@.75
Philadelphia	+1.50@1.65	1.12½	1.02¼	1.12½	1.00	1.12½@1.25	+.45@.50
Pittsburgh	1.62½	1.37½	—1.37½@1.43¾	1.00	.....	1.43¾	.75
St. Louis	1.75	1.50	1.50@1.65	1.15@1.25	1.50	1.50	.45@.77½
San Francisco	1.25	1.00	1.00	.81¼	1.00	1.12½	.50@.55
Seattle	1.37½	1.12½	1.00@1.12½	1.00	1.00@1.12½	1.12½	.50@.62½

much improved owing to Westward movement of labor in the direction of the harvest fields.

New Orleans—Skilled trades scarce; considerable surplus of common laborers.

New York—Bricklayers' strike called Aug. 3 as result of fourteen-year-old dispute between bricklayers and plasterers over jurisdictional rights. In 1911 the two trades signed a compact whereby each was to control certain territories. Union cards were interchangeable. Bricklayers allege that plasterers broke the treaty of 1911. Plasterers, in turn, allege attempted control of their organization by the bricklayers. On July 9, plasterers signed an agreement with the employers enabling members of their organization to return to work. The action of the bricklayers is retaliatory. Electrical trades present demands for wage advance of $1.50 per day above the present rate of $10.50. With the required six months' notice this request, if granted, would not become effective before Jan. 1, 1926.

Philadelphia — Building operations taking all local carpenters; more coming in from other points. Painters and carpenters talking strike. Bricklayers plentiful; unemployment among cement finishers. Construction operations slower than year ago.

Pittsburgh—Building trades and other mechanics in good demand. Plenty of common laborers.

St. Louis—Biggest building program in history of city now under way. Shortage of bricklayers and plasterers; bonuses being granted.

San Francisco—Shortage of bricklayers and plasterers; surplus of unskilled laborers; construction active.

Monthly Prices of Construction Materials

Ups and Downs of the Market

Pig Iron—Market rather dull; prices show little change from last month's levels; Birmingham iron makers expect all furnaces to be in operation by September.

Railway Supplies—Light rails and ties are lower in price than a month ago at important centers; track bolts, however, are advancing; heavy rails in good demand.

Pipe—Iron and steel pipe buying brisk with increasing firmness in price. Rise in c.-i. pipe of $2 per ton in Pittsburgh and Chicago during month. Mill price of sewer pipe firm; slight declines from July levels reported in Boston, New Orleans and Atlanta.

Road and Paving Materials—Despite a slight drop in street and road lettings during July from the month preceding, asphalt prices are firmer in the South. Slight decline reported in the Middle West. Wood blocks are down and a fluctuating market prevails in paving stone.

Sand, Gravel and Crushed Stone—Slight easing of prices on aggregates in the South and West, coupled with record cement shipments, is highly favorable to concrete construction.

COST of construction, generally, has shown no notable change during the past sixty days. Firmness with local adjustments upward occurred in prices of pipe, tile, reinforcing bars, lumber, scrap, steel sheets, explosives and liquid chlorine. A downward trend, however, is noted in such materials as light rails, ties, concrete aggregates, brick, cone-head boiler rivets, wire nails, spikes (except standard railroad), linseed oil and rope. Standard rails, wrought-steel pipe and tin plates have not changed in price at the mills during the past two years.

Lime and Cement—In the lime market, declines and advances are about balanced. Price of cement dropped 2c. in Indianapolis and 5c. per bbl. in Boston during month. Kansas City, Mo. reports rise of 10c. per bbl.

Brick and Hollow Tile — Brick is firmer in New England; unseasonal softness prevails elsewhere. Tile is up about 1½c. per block in Chicago and other Western centers; unchanged in the East.

Structural Steel—Mill operations during the last week in July were a trifle heavier than in the earlier part of the month; the present rate is higher than a year ago. Reinforcing bars are firmest of the heavy rolled materials, with the Pittsburgh base at the July level of $2 per 100 lb. The minimum on shapes and plates is 5 to 15c. per 100 lb. under that of a month ago for exceptional tonnages.

Lumber—Production and demand are both heavier than a year ago. Twenty-one cities reporting regularly to E. N.-R. show a general advance in all grades of lumber with the exception of a slight drop in pine timbers in Kansas City, Mo. and 1-in. fir boards in Detroit. In the New Orleans district yellow pine, all classes, rose $2 per M ft. in month, due to slower production rather than increased demand.

Iron and Steel Scrap—Market gaining strength. Advances prevail in New York, Birmingham and Chicago.

E. N.-R. Prices of Construction Materials

Price advances since last month are indicated by **heavy type**; declines by *italics*

PIG IRON—Per Gross Ton f.o.b.:

	Aug. 6	One Year Ago
CINCINNATI		
No. 2 Southern (silicon 2.25@2.75)	$23.05	$22.05@22.55
Northern Basic	22.27	20.00
Southern Ohio No. 2 (silicon 1.75@2.25)	22.77	21.77
NEW YORK, tidewater delivery		
Southern No. 2 (silicon 2.25@2.75)	27.37	28.05
BIRMINGHAM		
No. 2 Foundry (silicon 2.25@2.75)	19.00	18.00@18.50
PHILADELPHIA		
Eastern Pa., No. 2X (2.25@2.75 sil.)	23.26	22.77@23.27
Virginia No. 2 (silicon 2.25@2.75)	29.17	28.44@29.44
Basic	22.26	20.00@21.00
Gray Forge	22.75	21.00@22.00
CHICAGO		
No. 2 Foundry Local (silicon 1.75@2.25)	22.00	20.00
No. 2 Foundry Southern (silicon 2.25@2.75)	25.55	28.05
PITTSBURGH, including freight charge ($1.76) from the Valley		
No. 2 Foundry Valley (silicon 1.75@2.25)	22.77	25.00
Basic	22.77	25.00
Bessemer	22.77	28.26

SCRAP—The prices following are f.o.b., per gross ton paid to dealers and producers:

	New York		Chicago		Birmingham
No. 1 railroad wrought	*$13.50@*	**$14.00**	**$16.50@**	**$17.00**	*$12.00@$13.00*
Stove plate	*10.00@*	*11.50*	**15.75@**	**16.25**	13.00@ *14.50*
No. 1 machinery cast	**16.50@**	**17.00**	**19.00@**	**19.50**	*16.00@* 16.50
Machine shop turnings	**9.25@**	**9.75**	9.00@	9.50	7.00@ 8.00
Cast borings	*9.25@*	*9.75*	10.50@	11.00	7.00@ 8.00
Railroad malleable	**14.00@**	**14.50**	17.50@	18.00	17.00@ 18.00
Re-rolling rails	*13.00@*	*13.50*	*17.25@*	*17.75*	16.50@ 17.00
Re-laying rails	**23.00@**	**24.00**			21.00@ 22.00
Heavy melting steel	11.00@	13.00			13.00@ 14.00

Railway Supplies

STEEL RAILS—The following quotations are per ton f.o.b. for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh			Chicago	St. Louis
	Aug 6	One Year Ago	Birmingham		
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00	$46@49
Standard openhearth rails	43.00	43.00	43.00	43.00	48@52
Light rails, 8 to 10 lb.	*30@*36	38@40	34@36	1.80@1.90	
Light rails, 12 to 14 lb.	34@36	38@40	34@36	1.80@1.90	2.05@2.15*
Light rails, 25 to 45 lb.	34.00	38@40	34@36	1.80@1.90	1.95@2.10*
Re-rolled rails	27@28	35@36			

*Per 100 lb.

RAILWAY TIES—For fair-sized orders, the following prices per tie hold:

	6 In. x 8 In. by 8 Ft.	7 In. x 9 In. by 8½ Ft.
Chicago, White Oak, plain	*$1.40*	*$1.75*
Chicago, Empty Cell Creosoted	1.75	2.10
Chicago, Zinc treated	1.55	1.90
San Francisco, Green Douglas Fir	.84	1.14
San Francisco, Empty Cell Creosoted, Douglas Fir	1.70	2.25
St. Louis, White Oak, plain	*1.10*	*1.30*
St. Louis, Zinc treated	*1.50*	*1.70*
St. Louis, Red Oak, plain	*1.00*	*1.20*
St. Louis, Sap pine-cypress	.90	*1.10*
Birmingham, White Oak	1.25	1.45

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh mill for carload lots, together with the warehouse prices at the places named:

	Pittsburgh				San Francisco	Birmingham
	Aug. 6	One Year Ago	Chicago	St. Louis		
Standard spikes, ½-in. and larger	$2.80	$2.90@3.00	$3.55	$3.65	$4.35	$2.90
Track bolts	3.90@4.15	3.75@4.25	4.55	4.65	5.85	3.90
Standard section angle bars	2.75	2.75	3.30	3.40	4.00	3.85

Pipe

WROUGHT PIPE—The following discounts are to jobbers for carload lots at Pittsburgh mill:

BUTT WELD

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
1 to 3	62	50½	1 to 1½	30	13

LAP WELD

2	55	43½	2	23	7
2½ to 6	59	47½	2½	26	11
7 and 8	56	43½	3 to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	60	49½	1 to 1½	30	14
2 to 3	61	50½			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

WROUGHT PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black			
	New York	Chicago	Birmingham	St. Louis
1 to 3 in. butt welded	53%	**54%**	62%	**49%**
3½ to 6 in. lap welded	48%	**51%**	59%	46%

	Galvanized			
	New York	Chicago	Birmingham	St. Louis
1 to 3 in. butt welded	39%	**41%**	**50½%**	36%
3½ to 6 in. lap welded	35%	**38%**	**47½%**	33%

Malleable fittings, Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	Birmingham	Pittsburgh	New York		
			Aug. 6	One Year Ago	
4 in.	$45.00	**$54.00**	$55.60@56.60	$65.60@66.60	
6 in. and over	40.00	**50.00**	50.60@51.60	60.60@61.60	
		Chicago	St. Louis	San Francisco	
4 in.		**$54.20**	$51.60	$56.30	
6 in. and over		**50.20**	47.60	52.00	

Gas pipe and Class "A," $4 per ton extra.

CLAY DRAIN TILE—The following prices are per 1,000 lin.ft.:

Size, In.	New York Aug. 6	New York One Year Ago	St. Louis	Birmingham	San Francisco	Dallas
3	$48.00	$45.00	$40.00	$45.00		$73.00
4	50.00	55.00	40.00	56.00	$76.50	110.00
5	70.00	80.00		80.00	97.75	118.00
6	92.00	105.00	70.00	100.00	127.50	150.00
8	160.00	170.00	170.00	165.00	212.50	210.00

SEWER PIPE—The following prices are in cents per foot for standard pipe in car load lots, f.o.b., except as otherwise stated:

Size, In.	New York Delivered	Pittsburgh	Birmingham	St. Louis	Chicago	San Francisco	Dallas
3		$0.081	$0.10		$0.09	$0.12	
4		.081	.10	$0.10	.09	.15	$0.15
5		.1215	.135		.13½	.18	.18
6	$0.21	.1215	.135	.14	.13½	.21	.21
8	.35	.189	.21	.225	.21	.30	.325
10	.52	.2835	.315	.315	.31½	.42	.476
12	.66	.3645	.45	.405†	.43½	.56	.612
15	1.14†	.486	.54	.675†	.54	.92	1.02
18	1.65†	.675	.75	.945†	.75	1.32	1.53
20	1.98†	.81	.90	1.26†	.90		
22	2.65†	1.08	1.20		1.20		1.564
24	2.97†	1.215	1.35	1.62†	1.35	2.16	2.04
27	4.65†	2.405	2.665	2.45†	2.75	3.00	3.34
30	5.16†	2.664	2.952	3.00†	3.75	3.60	4.06
33	6.98†	3.60	3.96	3.55†	4.50		4.99
36	8.00†	4.10	4.51	3.95†	5.00		5.42

	3	5	8	12	24	36
Boston	$0.13	$0.20	*$0.30*	*$0.60*	*$2.00†*	*$5.50†*
Minneapolis			.25	.45	1.50	4.76†
Denver	.135*	.18*	.27	.47	1.70	
Seattle	.14		.35	.72†	2.60†	
Los Angeles	.1625	.195	.275	.495	1.65	
New Orleans	.115*	*.117**	.295	*.472‡*	1.575	
Cincinnati	.105	.1575	.245	.4725	1.575	4.715
Atlanta	*.10**	*.15**	*.25*	*.425*	*1.625*	
Montreal	.68‡	.45†	.70	1.35	4.50†	
Detroit	.07	.1125	.175	.3375	1.935†	5.6375†
Baltimore	.111	.166	.259	.499	1.665	4.92
Kansas City, Mo.	.15*	.21*	.33½	**.54**	2.16	
Philadelphia	.12	.18	.28	.54	1.80	4.60

*4-in., 6-in., 9-in., respectively. †Double Strength. ‡3-in. special.

Road and Paving Materials

ROAD OILS—Following are prices per gallon in tank cars, 8,000 gal. minimum f.o.b. place named:

		Aug. 6	One Year Ago
New York, 45% asphalt	(at terminal)	$0.065@$0.07	$0.055
New York, 65% asphalt	(at terminal)	.0675@.0725	.06
New York, binder	(at terminal)	.07 @.075	.065
New York, flux	(at terminal)	.07 @.075	.04
New York, liquid asphalt	(at terminal)	.07 @.075	.06
St. Louis, 40@50% asphalt		.049	.0475
St. Louis, 50@60% asphalt		.0527	.0481
Birmingham, 55% asphalt		.0475	
Dallas, 45% asphalt		.0495	.0495
Dallas, 55% asphalt		.0455	.0455
Dallas, binder		.061	.061
San Francisco, binder, per ton		13.50*	**11.00***

* F.o.b. Oleum, Cal. Freight to San Francisco, 80c. per ton.

E. N.-R. Prices of Construction Materials

ASPHALT—Price per ton in packages (350-lb. bbls. or 425-lb. drums) and in bulk in carload lots, f.o.b. points listed:

	Package	Bulk
New York (*Mexican*)	$23.50*	$19.50
Boston (*Mexican*)	22.50	18.00
Chicago (*Texas*)	27.00	23.50
San Francisco, *f.o.b. refinery*, Oleum, Cal.	19.50	13.50
Dallas (*Texas*)	27.10	21.10
Seattle, "*D*" *grade, California, f.o.b. Richmond*	19.50	13.50
Denver (*California*)	24.00	.....
Minneapolis, *f.o.b. Twin Cities* (*Stanolind*)	*25.10*	*19.10*
St. Louis (*Mexican*)	26.50	23.00
Baltimore (*Mexican*) (*f. o. b. refinery*)	22.50	18.50
Montreal (*Imperial*)	28.00	21.00
Atlanta (*Mexican*)	**33.40**	**29.40**
Detroit (*Mexican*)	27.00	23.00
Cincinnati (*Kentucky Rock*)	.....	11.65
Maurer, N. J. (*Bermudez*)	30.00	28.00
Maurer, N. J. (*Mexican*)	24.00	22.00
Philadelphia (*Mexican*)	24.00	22.00
Kansas City, Mo. (*Texas*)	27.30	25.30
Los Angeles ("*D*" *grade, California*)	19.50†	13.50†
Birmingham (*Mexican*)	27.00	21.00
New Orleans (*Mexican*)	**26.00**	17.00

*In drums. †f.o.b. El Segundo Refinery.

NOTE—Barrels or drums are optional in most cities. About 6 bbls. to the ton, and from 4 to 5 drums; 200 to 300 gal. to the ton.

PAVING STONE—

New York (grade I)	5-in. granite, 30 blocks per sq.yd.	$142.00 per M.
San Francisco	Basalt block 4x7x8	70.00 per M.
Boston	5-in. granite / 28 blocks per sq.yd.	132.00 per M.
Atlanta	Granite	2.50 per sq.yd.
Detroit	5-in. Granite	3.00 per sq.yd.
Baltimore	Granite	2.85 per sq.yd.
Montreal	Granite	104.75 per M.
New Orleans	Granite, 4x8x4	3.25 per sq.yd.
Cincinnati	Granite	135.00 per M.
St. Louis	4x8x4	1.65 per sq.yd.
Kansas City	Granite	*3.85* per sq.yd.
Philadelphia	Granite	3.90@4.25 per sq.yd.
Minneapolis	Sandstone	2.74 per sq.yd.

FLAGGING—

New York	Bronx, 4 ft. wide	$0.24 per sq.ft.
	Manhattan, 4 ft. wide	.24 per sq ft.
	Queens, 5 ft. wide	.26 per sq.ft.
	6x24-in. cross-walk	1.25 per lin.ft.

CURBING—*New York:* Bluestone per lin.ft., f.o.b. barge New York, 5x16 in., 88c.; *St. Louis:* Class "A" straight, delivered, 5x18 in., $1.05 per lin.ft.; roundings, $1.60. *Birmingham:* Limestone, 5x18-in., $1.05 per lin. ft.

WOOD BLOCK PAVING—

	Size of Block	Treatment	Per Sq.Yd
New York	3	16	$2.55
New York	3½	16	2.86
Boston	3½	18	2.55
Chicago	4	16	2.25
Chicago	3½	16	2.10
St. Louis	3½	16	2.40
St. Louis	4	16	2.70
Seattle	4	16	Off market
Minneapolis	3½	16	2.49
Atlanta	3½	16	2.00
New Orleans	3	16	2.20
New Orleans	3½	16	2.30
New Orleans	4	16	2.40
Dallas	4	18	3.90
Baltimore	3½	16	None used
Montreal	4	16	4.50
Detroit	3	16	1.94
Detroit	4	16	.....
Cincinnati	3½	16	*2.35*
Kansas City	4	16	*3.75*
Philadelphia	4	16	None used

Construction Materials

SAND AND GRAVEL—Price for cargo or carload lots to contractor is as follows, per cu.yd.:

	Gravel 1½ In. Aug. 6	Gravel 1½ In. One Year Ago	Gravel ¾ In. Aug. 6	Gravel ¾ In. One Year Ago	Sand Aug. 6	Sand One Year Ago
New York (*alongside dock*)	$1.75	$1.75	$1.75	$1.75	$1.00	$1.00
Denver	1.90	1.90	1.90	1.90	1.00	1.00
Chicago	*1.50*	2.00	*1.50*	2.75	*1.40*	2.75
St. Louis	1.45	1.45†	1.45	1.65†	1.18	1.18†
Seattle	1.50	1.50	1.50	1.50	1.50	1.50
Dallas	2.38	2.38	2.38	2.38	2.00	2.00
Minneapolis	1.65*	1.85*	1.65*	1.85*	1.25	1.25
Cincinnati	1.40†	1.40†	1.40†	1.40†	1.35†	1.35†
San Francisco	2.15	2.15	2.15	2.15	1.50	1.50
Boston	1.50†	1.40†	1.50†	1.40†	1.00†	1.00†
New Orleans	2.60	3.00	2.60	3.00	1.75	1.25
Los Angeles	0.85*†	1.45	0.85*†	1.55	0.50*†	1.20
Atlanta	1.90†	1.90†	1.90†	1.40†	1.40†	1.40†
Detroit	2.02	2.02	2.02	1.75	1.62	1.35
Baltimore	1.40	1.40	1.60	1.60	0.70*†	0.70*†
Montreal	1.25†	1.25†	1.25†	1.50†	1.25†	1.25†
Birmingham	2.00	2.00	2.00	2.00	1.25	1.30†
Philadelphia	2.10	2.10	2.10	2.10	1.50	1.50
Kansas City (Joplin chats)	4.00	.....	4.00	.....	0.66*†	0.66*†

New York—Grits, $1.75 per cu. yd.; ready mixed, $1.85.
Los Angeles—Freight from quarry, 70c. per ton, and is included in above price.
*At pit. † Per ton.

CRUSHED STONE—Price for cargo or carload lots, f.o.b. city, is as follows per cu.yd.:

	1½ In. Aug. 6	1½ In. One Year Ago	¾ In. Aug. 6	¾ In. One Year Ago
New York	$1.75	$1.75	$1.85	$1.85
Chicago	*1.10*	2.00	*1.35*	2.00
St. Louis	1.83*	1.75*	1.83*	1.75*
Dallas	2.40	2.83	2.83	2.83
San Francisco	2.15	2.15	2.15	2.15
Boston	1.60*	1.45*	1.60*	1.45*
Minneapolis	1.75	1.75	1.75	1.75
Kansas City	1.50	1.50	1.50	1.50
Denver	2.50	3.50	2.50	3.50
Seattle	3.00	3.00	3.00	3.00
Atlanta	2.00*	2.00*	2.00*	2.00*
Cincinnati	1.90*	1.90*	1.90*	1.90*
Los Angeles	*1.00**	1.00	*1.00**	1.00
Detroit	1.90*	1.70	1.90*	1.70
Baltimore	2.50	2.50	2.55	2.55
Montreal	1.80*	1.80*	.....	1.90*
Philadelphia	2.10	2.10	2.10	2.10
Pittsburgh	2.85	2.85	2.85	2.85
Cleveland	3.25*	3.25*	3.25*	3.25*
Birmingham	2.00	.....	2.00	.....

*Per ton.

CRUSHED SLAG—Price of crushed slag in carload lots, per net ton, at plant

	1½-In.	¾-In.	Roofing	Sand
Youngstown District	$1.25	$1.35	$2.00	$1.25
Steubenville District	1.25	1.30	2.00	1.30
Ironton District	1.40	1.40	2.00	1.40
Easton, Catasauqua, Pa.	.....	.....	2.50	.....
Birmingham, Ala.	*.80@.90*	1.15	2.05	.....
Buffalo, N. Y., and Erie, Pa.	1.25	1.25	2.25	1.25
Cleveland, Ohio	1.30	1.30	1.30	1.30
Eastern Pa. and Northern N. J.	1.25	1.25	2.50	1.25
Western Pennsylvania	1.25	1.25	2.50	1.25
Longdale and Glen Wilton, Va.	1.25	1.25	2.50	.....
Toledo, Ohio	1.25	1.25	1.50	1.25

LIME—Warehouse prices:

	Hydrated, per Ton—Finishing	Hydrated, per Ton—Common	Lump, per Barrel—Finishing	Lump, per Barrel—Common
New York	$18.20	$12.00@$13.10	$1.50*	$2.25@2.75*
Chicago	20.00	18.00	1.45†	**1.30**†
St. Louis	23.00	19.00	12.50‡	12.50‡
Boston	20.00	13.50@15.00	3.75*	3.00*
Dallas	*18.00*	.....	.....	1.85†
Cincinnati	16.80	14.30	.....	13.40‡
San Francisco	.....	22.00	.....	1.60†
Minneapolis	25.50	21.00 (white)	1.60@1.70†	1.35†
Denver	24.00	.....	.....	2.70†
Detroit	12.40	12.40	.....	17.00‡
Seattle, *paper sacks*	24.00	.....	2.80†	.....
Los Angeles	25.00	18.00	3.50	19.50‡
Baltimore	24.25	17.85	2.55†	.....
Montreal	.....	21.00	.....	10.50‡
Atlanta	22.50	14.00	*2.00*†	1.30†
New Orleans	24.00	16.00	**2.50**†	2.00†
Philadelphia	23.00	16.00	.....	1.21†
Kansas City	19.50	18.50	2.10*	1.85†
Birmingham	22.50	15.00	2.10†	1.85†

*Per 280-lb. bbl. (net). †Per 180-lb. bbl. (net). ‡Per ton.

NATURAL CEMENT—Price to dealers per bbl. for 500 bbl. or over, exclusive of bags:

	Aug. 6	One Year Ago
Minneapolis (Rosendale)	$2.80	$2.80
Kansas City (Ft. Scott)	1.35	1.50
Cincinnati (Utica)	1.72	1.72
Boston (Rosendale)	2.50	2.50
St. Louis (Carney)	2.30	2.35
Birmingham (Magnolia) pozzolan cement	2.40	2.10

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots f.o.b points listed *without bags*. Cash discount not deducted.

	Aug. 6	One Month Ago	One Year Ago
New York, del. by truck	$2.50@2.60	$2.50@2.60	$2.50@2.60
New York, alongside dock to dealers	2.15	2.15	2.15
Jersey City	2.33	2.33	2.33
Boston	*2.45*	2.50	2.64
Chicago	2.20	2.20	2.20
Pittsburgh	2.19	2.19	2.19
Cleveland	2.39	2.39	2.39
Detroit	2.35	2.35	2.40
Indianapolis	*2.39*	2.41	2.41
Milwaukee	2.35	2.35	2.35
Duluth	2.19	2.19	2.19
Peoria	2.37	2.37	2.37
Cedar Rapids	2.44	2.44	2.44
Davenport	2.39	2.39	2.39
St. Louis	2.30	2.30	2.30
San Francisco	2.31	2.31	2.61
New Orleans	2.40	2.40	2.40
Minneapolis	2.42	2.42	2.42
Denver	2.84	2.84	2.84
Seattle	2.65	2.65	2.90
Dallas	2.05	2.05	2.05
Atlanta	2.40	2.40	2.35
Cincinnati	2.47	2.47	2.47
Los Angeles	2.52	2.52	2.75
Baltimore	2.50	2.50	2.50
Birmingham	2.40	2.40	2.40
Kansas City, Mo.	**2.30**	2.20	2.82
Montreal	1.80	1.80	1.90
Philadelphia	2.41	2.41	2.41
St. Paul	2.42	2.42	2.42
Toledo	2.40	2.40	2.45

NOTE—Bags 10c. each, 40c. per bbl.; 20c. each in Canada, 80c. per bbl.

Current mill-prices per barrel in carload lots, without bags, to contractors:

Buffington, Ind	$1.95	Hudson, N. Y.	$2.05
Universal, Pa	1.95	Leeds, Ala	1.95
Steelton, Minn	2.00	Hannibal, Mo	2.05
Fordwick, Va	2.05	Lehigh Valley District	1.95
Mitchell, Ind	2.05	Wyandotte, Mich	2.10
Iola, Kan	1.95	Alpena, Mich	1.95
Mason City, Ia	2.00	Richard City, Tenn	2.05
La Salle, Ill	2.05	Kingsport, Tenn	2.05

E. N.-R. Prices of Construction Materials

TRIANGLE MESH—Price per 100 sq.ft. in carload lots:

PLAIN 4-INCH BY 4-INCH MESH

Style Number	Weight in Pounds per 100 sq.ft.	Pittsburgh Mill	Chicago District Mill	Warehouse: New York	St. Louis	Dallas	San Francisco
032	22	$0.97	$1.01	$1.39	$1.06	$1.13	$1.22
049	28	1.23	1.29	1.76	1.35	1.38	1.55
068	35	1.51	1.58	2.16	1.66	1.67	1.91
093	45	1.94	2.03	2.77	2.13	2.00	2.46
126	57	2.39	2.51	3.45	2.63	2.55	3.03
153	68	2.86	2.99	4.11	3.14	3.15	.....
180	78	3.28	3.43	5.70	3.60	3.47	.....
245	103	4.33	4.53	6.21	4.75	4.58	.....
287	119	5.00	5.24	7.19	5.50	5.26	6.35
336	138	5.80	6.07	8.35	6.37	6.11	.....
395	160	6.72	7.04	9.65	7.38	7.12	.....
PAVING							
036P	17	$0.74	$0.77	$1.06	$0.81	$0.76	.....
053P	24	1.04	1.09	1.50	1.14	1.07	.....
072P	31	1.32	1.38	1.90	1.45	1.39	.....
097P	40	1.70	1.78	2.45	1.87	1.90	.....
049R	24	1.04	1.09	.....	1.14	1.07	.....
067R	31	1.32	1.38	.....	1.45	1.39	.....
089R	40	1.70	1.78	.....	1.87	1.90	.....

In rolls, 48-, 52-, and 56-in. wide and in 150-, 200- and 300-ft. lengths. Galvanized is about 15% higher. Size of roll carried in New York warehouses, 48 in. wide x 150 ft. long, or 600 sq.ft.

EXPANDED METAL LATH—Prices in carload lots per 100 yd. for painted:

Weight in pounds	New York	Birmingham	St. Louis	San Francisco	Dallas
2.2	$19.00	$22.00	$21.00	$24.00	$23.50
2.5	20.50	23.00	23.00	26.00	25.00
3.0	23.50	26.00	27.00	30.00	28.50
3.4	25.00	28.00	29.00	33.00	31.00

BARS, CONCRETE REINFORCING—Current quotations per 100 lb.:

ROLLED FROM BILLETS

Inches	Pittsburgh Mill	Birmingham	Warehouse, Uncut: New York	Chicago	St. Louis	Dallas	San Francisco
½ and larger	$2.00	$2.25	$3.24	$3.00	$3.15	$3.38	$3.35
⅝	2.10	2.35	3.34	3.10	3.25	3.43	3.45
¾	2.20	2.45	3.44	3.20	3.35	3.48	3.55
⅞	2.40	2.65	3.64	3.40	3.55	3.63	3.75
1	3.00	3.25	4.24	4.00	4.15	3.78	4.35

For size and cutting extras, see bar card of July 15, 1923.

ROLLED FROM RAILS

	St. Louis	Dallas		St. Louis	Dallas
½ and larger	$2.55*	$2.80	½	$2.95*	*$3.02*
⅝ in.	2.65*	2.85	¼	3.55*	*3.20*
¾	2.75*	2.90			

* Warehouse shipments.

BRICK—Contractors price per 1,000 in cargo or carload lots is as follows:

	Common: Aug. 6	Common: One Month Ago	Common: One Year Ago	Paving 3-inch*	Block 4-inch*
New York (del.)	*$18@19*	$19@20	$20.15	$45.00	$51.00
New York (at dock)	*15@16*	16@17	16@17		
Chicago	12.00	12.00	18.00	42.00	45.00
St. Louis, salmon (del.)	16.00	16.00	16@18	37.50	40.00
Denver, salmon	12.00	12.00	12.00	.....	.....
Dallas	*11.60*	12.10	14.10	35.00	.....
San Francisco	15.50	15.50	15.50	.....	.....
Los Angeles	*11.50*	12.00	15.00	(not used)	
Boston (del.)	**18.00**	17.50	21.50	45.00	50.00
Minneapolis (del.)	13.50	13.50	13.00	.....	.....
Kansas City	14.50	14.50	16.50	(no market)	
Seattle	15.00	15.00	15.00	.....	42.50
Cincinnati	17.00	17.00	17.00	40.00	45.00
Montreal	17.50	17.50	17.50	100.00†	68.00
Detroit (del.)	*16.00*	16.00	17.50	37.50	40.50
Baltimore	18.00	18.00	18.00	40.00	45.00
Atlanta	10.50	10.50	11.00	40.00	.....
New Orleans	15.00	15.00	19.50	.....	.....
Birmingham	12.50	12.50	12.50	40.00	45.00
Philadelphia	19.00	19.00	19.00	40.00	50.00
Pittsburgh (del.)	16.00	16.00	16.00	.....	.....
Cleveland	14.00	14.00	16.00	.....	.....

*For paving blocks 3½x8½x3 and 3½x8½x4 respectively. †Imported.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York: Aug. 6 on Trucks*†	New York: One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco†	Perth Amboy N. J., Factory*
4x12x12	$0.1162	$0.1162	**$0.075**	$0.12	$0.078	$0.108	.....
6x12x12	.1743	.1743	**.096**	.....	.102	.156	.....
8x12x12	.2179	.2179	**.135**	.22	.14	.244	.....
10x12x12	.....	.....	**.167**	.....	.17	.....	$0.252
12x12x12	.....	.....	**.215**	.....	.198	.....	.312

*5 per cent off for cash. †Partition tile.

	4x12x12	8x12x12	12x12x12
Boston	$0.09	$0.175	.....
Minneapolis (f.o.b. cars)	.0636	.106	$0.189
Minneapolis (delivered)	.07	.116	.205
Cincinnati	.07485	.13745	.....
Kansas City	.085	.145	.....
Denver	.085	.155	.188
Seattle (delivered)	.10	.20	.30
Los Angeles	.085	.172	.....
New Orleans	.13	*.20*	.....
Detroit (delivered)	.0775	.1743	.....
Montreal	.12	.225	.30
Baltimore	.125	.27	.....
Atlanta	.0888	.1666	.....
Dallas	.10	.19	.275
Birmingham	.11	.1824	.22
Pittsburgh (delivered)	.068	.128	.179
Cleveland	.07	**.149**	.....

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham, together with quotations per 100 lb. from warehouses at place named:

	Pittsburgh Mill	Birmingham	Warehouse: New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.85@2.00	$2.05	$3.34	$4.15	$3.25	$3.10	$3.30
Channels, 3 to 15 in.	1.85@2.00	2.10	3.34	4.15	3.25	3.10	3.30
Angles, 3 to 16 in., ¼ in. thick	1.85@2.00	2.10	3.34	4.15	3.25	3.10	3.30
Tees, 3 in. and larger	1.85@2.00	2.10	3.34	4.15	3.35	3.10	3.30
Plates, ¼ in. thick and heavier	1.85@1.90	2.00	3.34	4.15	3.25	3.10	3.30

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Pittsburgh Mill	Warehouse: New York Aug. 6	New York One Yr. Ago	Chicago	St. Louis	San Francisco	Dallas
½ in.	$2.40@$2.50	$4.50	$4.00	$3.50	$3.65	$5.00	$4.75
CONE HEAD BOILER							
½ in.	*$2.75@2.90*	$4.70	*$4.10*	$3.70	$4.20	$5.20	$5.00
⅝ and ¹³⁄₁₆	*2.90@3.05*	4.85	4.26	3.80	4.45	5.35	5.15
¼ and ⅞	*3.15@3.30*	5.10	4.50	4.05	4.60	5.60	5.50

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh Mill	Birmingham	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	*$2.65*	$2.85	$3.15	*$3.50*	*$4.20*	$3.33	4.95
Cut	2.90	2.90		*5.00*	5.00	3.58	5.00

SHIP SPIKES—Current prices per 100 lb.:

In.	San Francisco: Galv.	San Francisco: Black	Seattle Black
½	*$7.50*	*$5.75*	$7.75
⅝	*7.05*	5.30	5.65
¾	*6.90*	5.15	5.50

Pittsburgh base in lots of 200 kegs or more, $3.25.

PREPARED ROOFINGS—Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $2.75 per roll to consumers in less than carload lots f.o.b. Philadelphia.

Single shingles, red and green slate finish, cost $7.56 per square (sufficient to cover 100 sq.ft.) in less than carload lots, f.o.b. Philadelphia. Strip shingles (4 in 1) f.o.b. Philadelphia, l.c.l., $5.80 per square.

ROOFING MATERIALS—Prices f.o.b. New York, to consumers in less than carload lots:

Tar felt (14 lb. per square of 100 sq.ft.) per ton	$84.38
Tar pitch (in 400-lb. bbl.), per 100 lb.	1.86
Asphalt roofing (in barrels), per ton, f.o.b. plant	38.81
Asphalt felt (light), per ton, f.o.b. plant	87.75
Asphalt felt (heavy), per ton, f.o.b. plant	87.75

Delivered in Metropolitan Dist., $2.00 additional.

WINDOW GLASS—United inches, 25, bracket size 6x8 to 10x15, single thickness "AA," 82 per cent; "A," *87* per cent; "B," 88 per cent. Double thickness "AA," 82 per cent; "A," *88* per cent; "B," *89* per cent discount from jobbers list at New York warehouses.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	$2.30@**2.40**	*$3.60*	$3.50	$3.70	$3.89
No. 12	2.35@**2.45**	*3.65*	3.55	3.75	3.94
No. 14	2.40@**2.50**	*3.70*	3.60	8.80	3.99
No. 16	2.50@**2.60**	*3.80*	3.70	3.90	4.09
Black					
*Nos. 17 to 21	**2.95**@3.00	*4.30*	3.80	4.45	4.15
*Nos. 22 to 24	**3.00**@3.05	*4.35*	3.85	4.50	4.20
*No. 26	**3.05**@3.10	*4.40*	3.90	4.55	4.25
*No. 28	**3.15**@3.20	*4.50*	4.00	4.65	4.35
Galvanized					
No. 10 and 11	**3.20**@3.25	*4.65*	4.00	4.75	4.35
No. 12 to 14	**3.30**@3.35	*4.75*	4.10	4.85	4.45
No. 16	**3.45**@3.50			5.00	4.60
Nos. 17 to 21	**3.60**@3.65	*5.05*	4.40	5.15	4.75
Nos. 22 to 24	**3.75**@3.80	*5.20*	4.55	5.30	4.90
*Nos. 25 and 26	**3.90**@3.95	*5.35*	4.70	5.45	5.05
*No. 28	**4.20**@4.25	*5.65*	5.00	5.75	5.35

* For painted corrugated sheets add 30c. per 1,000 lb. for 5 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets add 15c., all gages.

LINSEED OIL—These prices are per gallon:

	New York: Aug. 6	New York: One Year Ago	Chicago: Aug. 6	Chicago: One Year Ago
Raw in barrels (5 bbl. lots)	*$1.01*	**$1.05**	*$0.95@$1.00*	$0.94

E. N.-R. Prices of Construction Materials

WHITE AND RED LEAD—Per 100-lb. keg, base price, f.o.b. New York:

	Dry		In Oil	
	Aug. 6	1 Yr. Ago	Aug. 6	1 Yr. Ago
Red	$15.75	$14.50	$17.25	$16.00
White	15.75	14.50	15.75	14.50

Lumber

Prices wholesale, per M. ft. b.m., to dealers in carload lots, f.o.b.

San Francisco—Prices of rough Douglas fir No. 1 common, in carload lots to dealers at yards. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$26.00	$27.00	$28.00	$31.00
3x6 and 8	26.00	27.00	28.00	31.00
4x4-6 and 8	26.00	27.00	28.00	31.00
3x10 and 12	26.00	27.00	28.00	31.00
3x14	30.00	30.00	32.00	34.00
4x10 and 12	26.00	27.00	28.00	31.00
4x14	30.00	30.00	32.00	34.00
	24 Ft. and Under		25 to 32 Ft.	33 to 40 Ft.
6x10	$28.00		$30.00	$32.00
6x14	34.00		36.00	38.00
8x10	28.00		30.00	32.00
8x14	34.00		36.00	38.00

New York and Chicago—Wholesale prices to dealers of long leaf yellow pine.

	New York*		Chicago	
	20 Ft. and Under	22-24 Ft.	20 Ft. and Under	22-24 Ft.
3x4 to 8x8	$45.00	$46.00	$36.00	$37.00
3x10 to 10x10	49.00	50.00	39.00	40.00
3x12 to 12x12	54.00	55.00	43.00	44.00
3x14 to 14x14	62.00	63.00	49.00	50.00
3x16 to 16x16	70.00	71.00	42.00	43.00
3x18 to 18x18			44.50	45.50
4x20 to 20x20			48.50	49.50

* Wholesale price to dealers; to contractors, delivered from lighters or cars to job, $5 additional. Short leaf pine costs $3 per M. less.

Over 24 ft.—Add $1 for each additional 2 ft. in length up to 30 ft. for sizes 12x12 and under; for sizes over 12x12 add $2; for merchantable add $2 to sizes 10x10 and under

Other Cities

	8x8-In. x 20 Ft. and Under				12x12-In. 20 Ft. and Under	
	P.	Fir*	Hemlock	Spruce	P.	Fir*
Boston	$50.00	$48.00†	$50.00	$50.00	$60.00	$58.00†
Seattle		30.50				24.00
New Orleans	44.00				34.00	
Baltimore	32.50	49.25	53.00	60.00	38.00	49.75
Cincinnati	37.00	73.00	73.00	85.00	48.00	77.00
Montreal	50.00	58.00			60.00	65.00
Los Angeles		40.00				40.00
Denver		37.25	37.25	37.25		37.75
Minneapolis	43.00	38.75	35.00		44.50	38.75
Atlanta	31.00				34.00	
Dallas	56.00				56.00	
Kansas City, Mo.	*39.00*				*50.00*	
Birmingham	32.00				34.00	
Philadelphia	54.00	34.00	37.00	40.00	62.00	34.00
Detroit	44.75	50.75			54.75	50.75
St. Louis	39.25				48.25	

	1-In. Rough, 10 In. x 16 Ft. and Under			2-In. T. and Gr. 10 In. x 16 Ft.	
	P.	Fir*	Hemlock	P.	Fir*
Boston	$45.00	$42.00†	$44.00	$50.00	$48.00†
Seattle		26.00			30.00
New Orleans	82.00			42.00	
Baltimore	55.00	44.00	44.00	34.00	50.00
Cincinnati	70.00	79.00	75.00	38.00	85.00
Montreal	56.00	50.00	45.00	45.00	45.00
Los Angeles		35.00			95.00
Denver		30.25	30.25		32.75
Minneapolis	43.00	37.75	34.75	38.00	35.25
Atlanta	18.00			28.00	
Dallas	52.00			56.00	
Kansas City, Mo.	65.50				
Birmingham	45.00				
Philadelphia	32.00	33.00	36.00	54.00	34.00
Detroit	37.25	*37.50*		44.00	41.75
St. Louis	43.25			29.75	

Birmingham—Quotes carload lots, f.o.b. sidings; $4.00 additional per M. ft. to contractors.
Boston and Cincinnati—Prices to contractors in carload lots, f.o.b.
Denver—Quotes dealers price to contractors on large projects.
St. Louis—Wholesale price to contractors, f.o.b. cars, $2 per M.ft. additional.
Seattle—Price to contractors, delivered.
Dallas—Wholesale to contractors, $10 per M.ft. additional.
*Douglas fir. †Prime.

PILES—Prices per lineal foot, pine piles with bark on, f.o.b. New York.

Diameters	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.14½	$0.18½
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.19	.23½
12 in.—2 ft. from butt	6 in.	60 to 69 ft.	.21½	.25½
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.25½	.34
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.27½	.36½
14 in.—2 ft. from butt	5 in.	80 to 89 ft.	.35	.41½

Miscellaneous

STEEL SHEETPILING—The following price is base per 100 lb. f.o.b. Pittsburgh, with a comparison of a month and a year ago:

Aug. 6	One Month Ago	One Year Ago
$2.25@2.30	$2.25@2.30	$2.30@2.40

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	Eastern Territory New York and East of Missouri River
Plow steel round strand rope	35%
Special steel round strand rope	30%
Cast steel round strand rope	20%
Round strand iron and iron tiller	5%
Galvanized steel rigging and guy rope	7½%
Galvanized iron rigging and guy rope	+12½%

California, Oregon, Nevada and Washington: Discount 5 points less than discount for Eastern territory.
Wyoming, New Mexico and Colorado: Discount 5 points less than discount for Eastern territory.
Arizona: Discount 10 points less than discount for Eastern territory.
Montana, Idaho and Utah: Discount 10 points less than discount for Eastern territory.
North Dakota, Nebraska, Kansas, Oklahoma and Texas: Discount 5 points less than discount for Eastern territory.

MANILA ROPE—For rope smaller than ¾-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft., there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ¾-in., 8 ft.; ⅞-in., 6; 1-in., 4½; 1-in., 3½; 1¼-in., 2 ft. 10 in.; 1¼-in., 2 ft. 4 in. Following is price per pound for ¾-in. and larger, in 1200-ft. coils:

Boston	$0.19@.23	New Orleans	$0.24½
New York	.27	Los Angeles	.24½
Chicago	.24	Seattle	.17
Minneapolis	.26½	St. Louis	.26½
San Francisco	.24	Montreal	.16
Atlanta	.30	Detroit	.26
Denver	.28	Baltimore	.18
Cincinnati	.21	Kansas City	.21½
Dallas	.31	Birmingham	.23@.25
Philadelphia	.21		

EXPLOSIVES—Price per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.27	$0.295
Boston	.225	.25
Kansas City	.2025	.2225
Seattle	.165	.19
Chicago	.22	.245
Minneapolis	.1917	.2123
St. Louis	.22	.245
Denver	.2025	.2275
Dallas	.225	.302
Los Angeles	.1875	.2125
Atlanta	.23	.255
Baltimore	.22	.23
Cincinnati	.22	.245
Montreal	.195	.235
Birmingham	.23	.255
New Orleans	.233	.26
San Francisco	.1625	.1925
Philadelphia	.215	.24

CHEMICALS—Water and sewage treatment chemicals, spot shipments in carload lots, f.o.b. works:

Sulphate of aluminum, in bags, per 100 lb	$1.40@1.45
Sulphate of copper, in bbl., per 100 lb	4.50@4.60
Soda ash, 58%, in bags, per 100 lb	1.25
Chlorine, liquid, tanks, per lb	.04@.04½
Hypochlorite of lime (bleaching powder) in drums, per 100 lb	1.90@2.00

FREIGHT RATES—On finished steel products in the Pittsburgh district, including plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc., the following freight rates are effective in cents per 100 lb., in carloads of 36,000 lb.:

Atlanta	$0.58	Detroit	$0.29
Baltimore	.31	Kansas City	.735
Birmingham	.58	New Orleans	.67
Boston	.365	New York	.34
Buffalo	.265	Pacific Coast (all rail)	1.15*
Chicago	.34	Philadelphia	.32
Cincinnati	.29	St. Louis	.43
Cleveland	.19	St. Paul	.60
Denver	1.15*		

* Minimum carload, 50,000 lb., structural steel only; 80,000 lb., for other iron or steel products.